TO COMPARE THE EASE OF PERFORMING TRANSNASAL FLEXIBLE LARYNGOSCOPY USING DIFFERENT TOPICAL PREPARATIONS AND METHODS OF APPLICATION

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF M.S BRANCH IV OTORHINOLARYNGOLOGY EXAMINATION OF THE TAMIL NADU DR. M.G.R.MEDICAL UNIVERSITY TO BE HELD IN MAY, 2018.

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DEPARTMENT OF OTORHINOLARYNGOLOGY

CHRISTIAN MEDICAL COLLEGE

VELLORE

CERTIFICATE

I declare that this dissertation entitled **"To compare the ease of performing transnasal flexible laryngoscopy using different topical preparations and methods of application''** submitted towards partial fulfilment of the requirements of the Tamil Nadu Dr. M.G.R.Medical University for the MS Branch IV, Otorhinolaryngology examination to be conducted in May 2018, is the bonafide work done by me, and due acknowledgements have been made in text to all materials used.

Dr. Asha K Joy

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Department of Otorhinolaryngology

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DEPARTMENT OF OTORHINOLARYNGOLOGY

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Dr. Anna B. Pulimood

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Dr. Suma Susan Mathews

Professor and Guide,

Department of Otorhinolaryngology,

Christian Medical College,

Vellore.

ACKNOWLEDGEMENTS

I would like to thank God Almighty for being with me each step of the way and helping me to finish this dissertation.

I wish to express my sincere gratitude to my guide Dr. Suma Susan Mathews, Professor, Department of Otorhinolaryngology, Christian Medical College and Hospital, Vellore, for all her hard work, wisdom, motivation, expert guidance and encouragement without which this dissertation would not have been possible. I could not have imagined having a better advisor and mentor for my dissertation.

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I am extremely grateful to Dr. Ajay Philip from the Department of Otorhinolaryngology for his valuable help, advice and guidance in this study.

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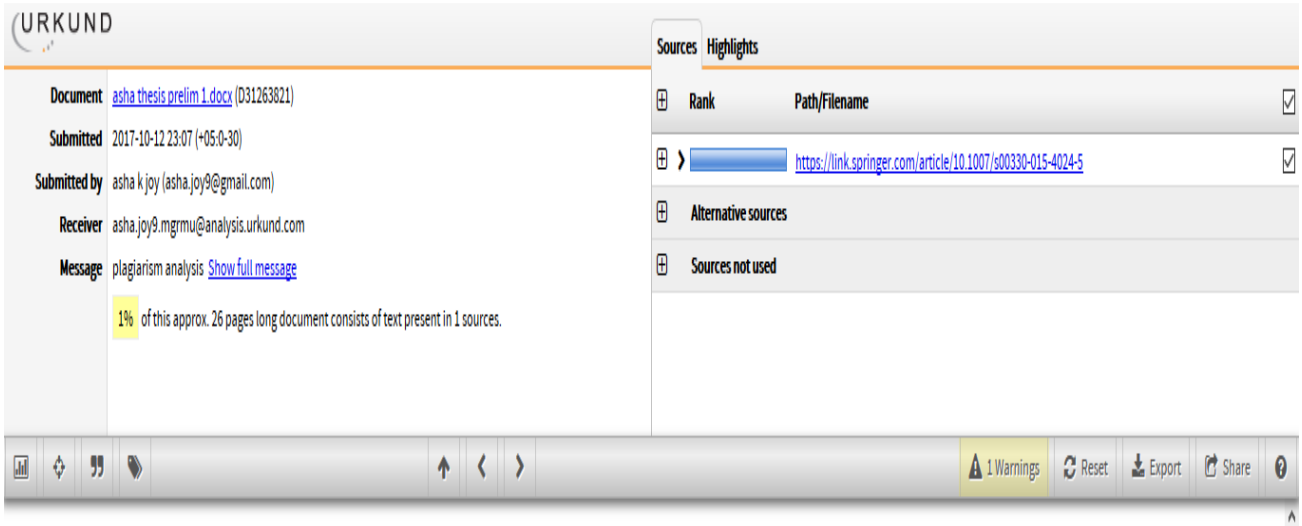
I would also like to thank the Fluid Research Committee, CMC Hospital for granting me permission for conducting this study.

A special thanks to my parents, my husband Mr. Cyrus Kallupurackal and my son Master Nathan C. Thomas for their love, concern and support throughout the work on this study.

ANTI-PLAGIARISM CERTIFICATE



INTRODUCTION: The field of laryngology developed because of man's inherent desire to understand the body's internal mechanism which helps in communicating with his fellow being. Prior to the development of endoscopes, the visualization techniques for the larynx included an indirect mirror laryngoscopy (IDL) and rigid direct laryngoscopy. Though IDL is less expensive and easily available, the technique required masterly skill along with patient compliance providing at times an inadequate view of the larynx. Rigid laryngoscopy often required general anaesthesia and was very uncomfortable for the patient if done under local anaesthesia. The introduction of flexible laryngoscopy provided an excellent view of the larynx in normal anatomic position and was well tolerated by the patient. Learning the skill to perform a flexible laryngoscopy therefore became essential and is now included in the armamentarium of a practicing Otorhinolaryngologist. Many agents have been used to facilitate a smooth examination. Studies have compared different preparations to placebo and none (1–5), but it remains unclear which is the best to use, if at all required. Further, there have been no Indian studies looking at the efficiency of various topical agents to facilitate flexible nasopharyngolaryngoscopy. Hence this Open label Randomized control study was designed to answer these questions among the Indian population.

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AIM OF THE STUDY: The aim of our study was to compare the efficacy of topical agents in relieving pain and discomfort during the flexible fibreoptic nasopharyngolaryngoscopy (NPL) and improving introduction and advancement of the endoscope, thus facilitating the completion of the procedure.

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Ethics Committee Registration No: ECR/326/INST/TN/2013 issued under Rule 122D of the Drugs & Cosmetics Rules 1945, Govt. of India

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Secretary, Research Committee

Prof. Keith Gomez, B.Sc., MA (S.W), M.Phil.
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Dr. Alfred Job Daniel, D Ortho MS Ortho DNB Ortho.
Chairperson, Research Committee & Principal

Dr. Biju George, MBBS., MD., DM
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

April 09, 2016

Dr Asha K Joy
PG Registrar,
Department of ENT,
Christian Medical College,
Vellore – 632 004.

Sub: **Fluid Research Funding: New Proposal**
To compare the ease of performing transnasal flexible laryngoscopy using different topical preparations and methods of application.
Dr Asha K Joy (Employment Number: 29366), PG registrar, ENT, Dr Suma Susan Mathews , Employment Number: 14423, ENT unit 5, Dr Rita Ruby Anbuselvi A., emp no: 10817 ENT 5, Dr Ajay Philip, emp no: 32421, ENT, Dr B Antonisamy (emp no: 3090), Biostatistics.

Ref: IRB Min No: 9801 [INTERVEN] dated 16.12.2015

Dear Dr Asha K Joy,

I enclose the following documents:-

1. Institutional Review Board approval 2. Agreement

Could you please sign the agreement and send it to Dr. Biju George, Addl. Vice Principal (Research), so that the grant money can be released.

With best wishes,

Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

Dr. BIJU GEORGE
MBBS., MD., DM
SECRETARY - (ETHICS COMMITTEE)
Institutional Review Board,
Christian Medical College, Vellore - 632 002.

Cc: Suma Susan Mathew, Department of ENT, CMC, Vellore.

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Dear Dr Asha K Joy ,

The Institutional Review Board (**Silver**, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project titled "To compare the ease of performing transnasal flexible laryngoscopy using different topical preparations and methods of application" on December 16th 2015.

The Committee reviewed the following documents:

1. IRB Application format
2. Proforma
3. Information Sheet and Informed Consent Form (English, Tamil, Hindi, Bengali)
4. Cvs of Drs. Antonisamy, Asha K Joy, Suma Susan Mathews, Ajay Philip, Rita Ruby Anbuselvi A
5. No.of documents 1- 4

The following Institutional Review Board (**Silver**, Research & Ethics Committee) members were present at the meeting held on December 16th 2015 in the CREST/SACN Conference Room,Christian Medical College, Bagayam, Vellore 632002.

Name	Qualification	Designation	Affiliation
Dr. George Thomas	MBBS, D Ortho, PhD	Orthopaedic Surgeon, St. Isabella Hospital, Chennai, Chairperson, Ethics Committee, IRB, Chennai	External, Clinician
Dr. B. Antonisamy	MSc, PhD, FSMS, FRSS	Professor, Biostatistics,Secretary (Research Committee), IRB, CMC, Vellore	Internal, Statistician
Dr. Prasanna Samuel	MSc, PhD	Lecturer, Biostatistics, CMC, Vellore	Internal, Statistician
Dr. Nihal Thomas	MD, MNAMS, DNB (Endo), FRACP (Endo) FRCP(Edin)FRCP (Glasg)	Professor & Head, Endocrinology,	Internal, Clinician
Dr. Biju George	MBBS, MD, DM	Professor, Haematology, Additional Vice Principal (Research), Deputy Chairperson (Research Committee), Member Secretary (Ethics Committee), IRB, CMC, Vellore.	Internal, Clinician
Dr. B. Poonkuzhali	MSC, PhD	Professor, Haematology, CMC, Vellore	Internal, Basic Medical Scientist
Dr. Jayaprakash Muliyil	BSc, MBBS, MD, MPH, Dr PH (Epid), DMHC	Retired Professor, CMC, Vellore	External, Scientist &Epidemiologist
Dr. Suresh Devasahayam	BE, MS, PhD	Professor of Bio-Engineering, CMC, Vellore	Internal, Basic Medical Scientist
Rev. Dr. T. Arul Dhas	MSc, BD, DPC, PhD(Edin)	Chaplaincy Department, CMC, Vellore	Internal, Social Scientist
Dr. Sathya Subramani	MD, PhD	Professor, Physiology, CMC, Vellore	Internal, Clinician

Prof. Keith Gomez	BSc, MA (S.W), M. Phil (Psychiatry Social Work)	Student counselor, Loyola College, Chennai, Deputy Chairperson, Ethics Committee, IRB	External, Lay Person & Social Scientist
Dr. P. Zachariah	MBBS, PhD	Retired Professor, Vellore	External, Clinician
Dr. D. J. Christopher	BSc, MBBS, DTCD DNB, FRCP(Glasg), FCCP(USA)	Professor, Pulmonary Medicine, Associate Director (HR), CMC, Vellore	Internal, Clinician
Dr. Asha Mary Abraham	MBBS, MD, PhD	Professor, Virology,CMC, Vellore	Internal, Clinician
Mr. C. Sampath	BSc, BL	Advocate, Vellore	External, Legal Expert
Mrs. Pattabiraman	BSc, DSSA	Social Worker, Vellore	External, Lay person
Dr. Denise H. Fleming	BSc (Hons), PhD	Honorary Professor, Clinical Pharmacology, CMC, Vellore	Internal, Scientist & Pharmacologist
Dr. Vinitha Ravindran	PhD (Nursing)	Professor & Addl. Deputy Dean, College of Nursing, CMC, Vellore	Internal, Nurse
Dr. Shirley David	MSc, PhD	Professor, Head of Fundamentals Nursing Department, College of Nursing, CMC, Vellore	Internal, Nurse

We approve the project to be conducted as presented.

The Institutional Ethics Committee expects to be informed about the progress of the project, any **adverse events** occurring in the course of the project, any **amendments in the protocol and the patient information / informed consent**. On completion of the study you are expected to submit a copy of the **final report**. Respective forms can be downloaded from the following link: http://172.16.11.136/Research/IRB_Polices.html in the CMC Intranet and in the CMC website link address: http://www.cmch-vellore.edu/static/research/Index.html.

Kindly provide the total number of patients enrolled in your study and the total number of withdrawals for the study entitled: "To compare the ease of performing transnasal flexible laryngoscopy using different topical preparations and methods of application" on a monthly basis. Please send copies of this to the Research Office (research@cmcvellore.ac.in).

Fluid Grant Allocation:

A sum of Rs. 14,000/- INR (Rupees Fourteen Thousand Only) will be granted for 1 year.

Yours sincerely

Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

Dr. BIJU GEORGE
MBBS., MD., DM
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CONTENTS

INTRODUCTION

The field of laryngology developed because of man's inherent desire to understand the body's internal mechanism which helpsin communicating with his fellow being.

Prior to the development of endoscopes, the visualization techniques for the larynx included an indirect mirror laryngoscopy (IDL) and rigid direct laryngoscopy. Though IDL is less expensive and easily available, the technique required masterly skill along with patient compliance providing at times an inadequate view of the larynx. Rigid laryngoscopy often required general anaesthesia and was very uncomfortable for the patient if done under local anaesthesia. The introduction of flexible laryngoscopy provided an excellent view of the larynx in normal anatomic position and was well tolerated by the patient. Learning the skill to perform a flexible laryngoscopy therefore became essential and is now included in the armamentarium of a practicing Otorhinolaryngologist.

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To assess the effectiveness of the topical agents used during NPL scopy in :

1. Relieving pain and discomfort during the procedure;

2. Improving introduction and advancement of the endoscope;

3. Facilitating the chance of complete examination.

This study had four intervention arms:

i) 10% lignocaine spray

ii) 2% lignocaine gel

iii) 4%lignocaine solution with xylometazoline (1:1) pledgets

iv) Aqueous gel.

REVIEW OF LITERATURE

HISTORY OF LARYNGOLOGY:

The earliest studies in Laryngology date back to the Greek civilization where Hippocrates (400 B.C.) advocated the concept of minimally invasive procedures and proposed that the epiglottis prevents food from entering the airway.(6) .It was in the Roman era that dental mirrors were used to explore the oral cavity. Galen of Pergamon in the second century AD, despite the stiff Roman resistance in conducting cadaveric dissections, performed vivisection and named the epiglottis and recurrent laryngeal nerve(6,7).

Fig 1: Galen, Adapted from Google Images

Julio Casserius ,an Italain , student of Hieronymus Fabriciusgave a detailed description of the anatomy of the larynx of mammals including humans in his book "The Anatomy of Voice and Hearing"(6,8).

The 19th and 20th centuries saw a major boom in technology with the advent of microscopes, endoscopes and stroboscopes with subsequent advancements and improvisations in operative interventions and techniques in the field of laryngology.

Philip Bozzini in 1807 used an external light source (candle-light) channelledby mirrors, placed in an instrument called the Lichtleiter or light conductor. He did not observe the larynx, but his efforts did advance the entire field of endoscopy and he is regarded as the father of minimally invasive surgery.(6,9).

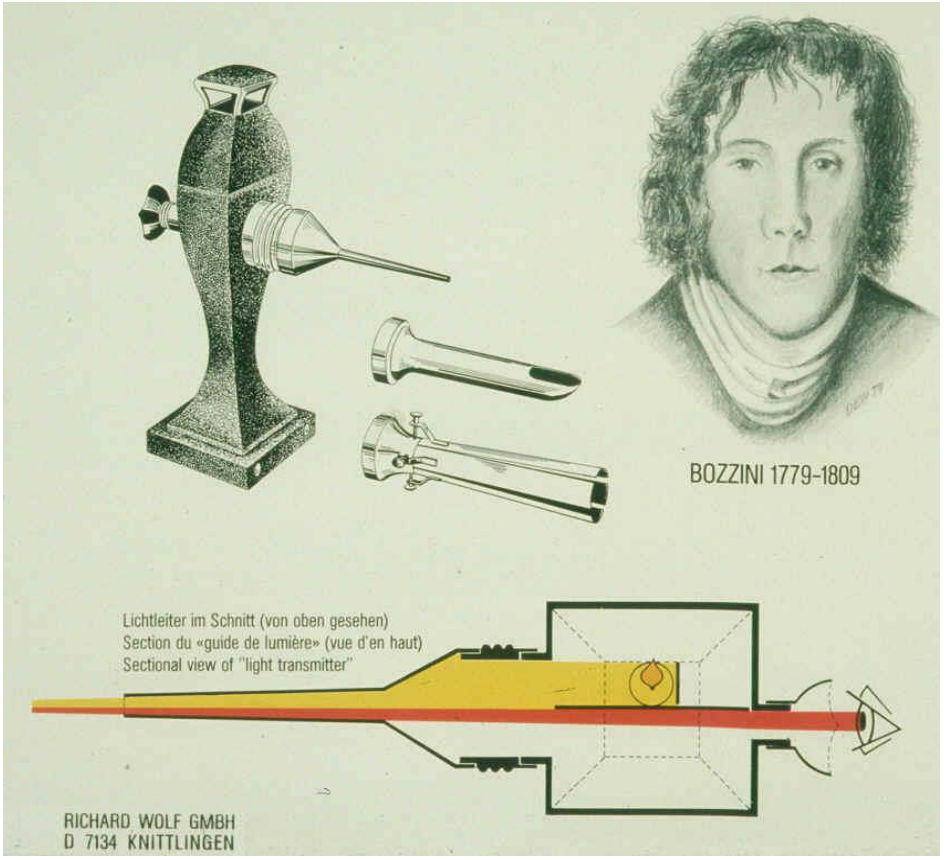


Fig 2: Philip Bozzini and the early endoscope "Lichtleiter", Adapted from Google Images

The early efforts at visualizing the larynx were all variations of the indirect laryngoscopy using a set of mirrors to reflect back the image to the observer while using an external light source. Benjamin Babington is credited with first developing the “laryngoscope” in 1829, an indirect laryngoscope called glottoscope, which used direct sunlight and mirrors(6,10). Fredrich Hoffman, Liston and Avery in the mid 1800s used concave mirrors which are classically associated with the otolaryngologist. Manuel Garcia, a musician, is oftentimes credited with viewing his vocal cords; described vocal fold motion and generation of voice from the vocal folds in his book ”Observations on the Human Voice”(6).

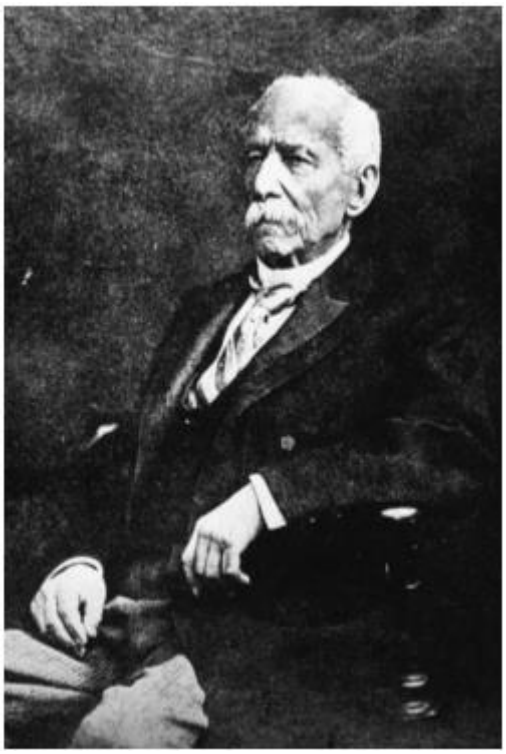


Fig 3: Manuel Garcia, Adapted from Laryngeal Evaluation, Kendall et al.

With the discovery of the light bulb by Thomas Edison in 1879 and topical anaesthesia for the larynx in 1884, many hurdles in the examination of larynx were eliminated. Johann Czermak was the first to use artificial light source and a curved mirror in 1888(6,8).

Fig 4: Johann Nepomuk Czermak (1828–1873), Adapted from Laryngeal Imaging, Kendall et al.

In the middle of the 19th century, laryngology was a field which was practised by physicians and neurologists; Jacob Solis-Cohen, a general surgeon, helped in making it a surgical speciality(6).

The term endoscopy was coined by Antonin Desormeaux, a urologist, in 1853(6,11) Direct laryngoscopy, bronchoscopy and oesophagoscopy developed in parallel with each other through sharing of technical advancements. Kussmaul studied the concept of sword swallowers and applied it to view the oesophagus using Desormeaux

urethroscope; thus performing the first direct oesophagoscopy in 1868. Alfred Kirsten is credited with developing the first true direct laryngoscope in 1895 and he named it "autoscope"(7,8).

Fig 5: Alfred Kirsten performing laryngoscopy, Adapted from Laryngeal Imaging, Kendall et al

Gustav Killian started using rigid scopes for exploring the airway and he was the first to use a 9mm tube beyond the carina. He also coined the term "bronchoscopy" and introduced the supine position. He developed the inverted V laryngoscope blade to better view the anterior commissure and introduced laryngeal suspension that advanced bimanual surgery and allowed the surgeon to draw diagrams to illustrate the findings(6,8).

Fig 6: Gustav Killian performing suspension laryngoscopy, Adapted from Laryngeal Imaging, Kendall et al.

Chevalier Jackson developed a practical distal lighting method for endoscopic equipment in 1905, by using a side channel (tube within a tube concept). He also introduced distal suction for endoscopes(6,10).

Fig 7: Chevalier Jackson (1865-1958), Adapted from Laryngeal Imaging, Kendall et al.

Yankauer in 1910 developed a laryngoscope wide enough for binocular vision and started using magnification for laryngeal surgeries.

Documentation of findings of laryngeal pathology remained a challenge in early laryngology history. Laryngoscopic photography was introduced by Stein in collaboration with Czermak, and the technique was perfected by French(10). However, the images lacked optimal resolution, were difficult to obtain and required cumbersome equipment and exception skill (citation), thus providing great scope for improvement.

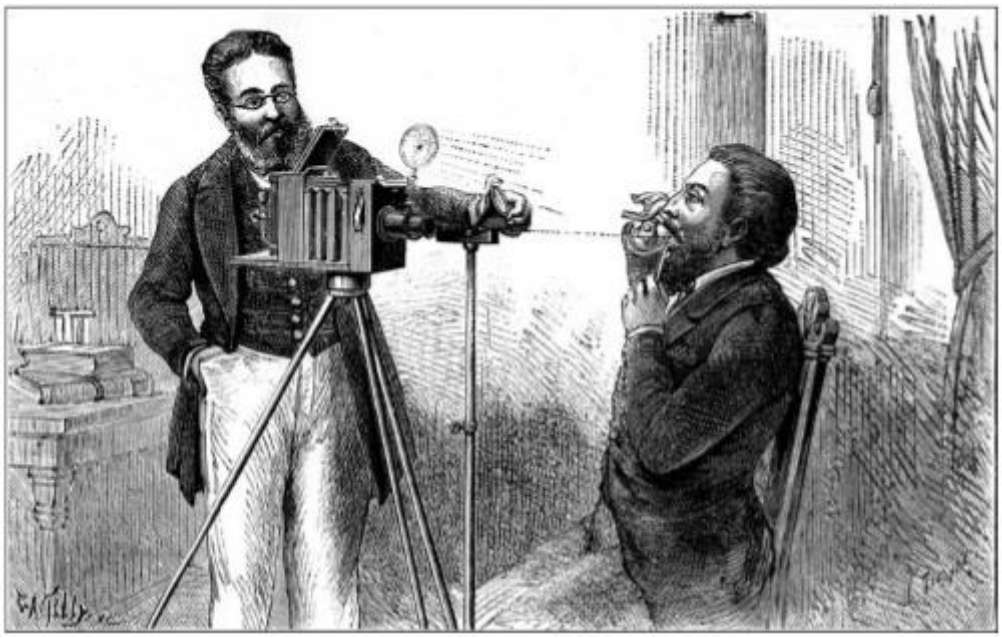


Fig 8: Stein's laryngeal photography, Adapted from Laryngeal Imaging, Kendall et al.

The binocular microscope was introduced by the Zeiss Optical Company in 1953 and in 1960, Scalco described the use of the microscope with the Lynch suspension

laryngoscope(6,12). Harold Hopkins invented the rod lens optical system in 1959 wherein a glass rod was used to replace the air interspace between lenses of the telescopes at that time. The new design provided a wider viewing angle and absorbed less light during image transmission(6,13). Karl Storz after observing the prototype for the flexible fibreglass gastroscope, began developing the idea of coupling a fiber optic light source with rigid endoscopes. In 1965, Storz partnered with Hopkins to develop the Storz-Hopkins telescope which had unmatched illumination and superb image resolution(6,13)

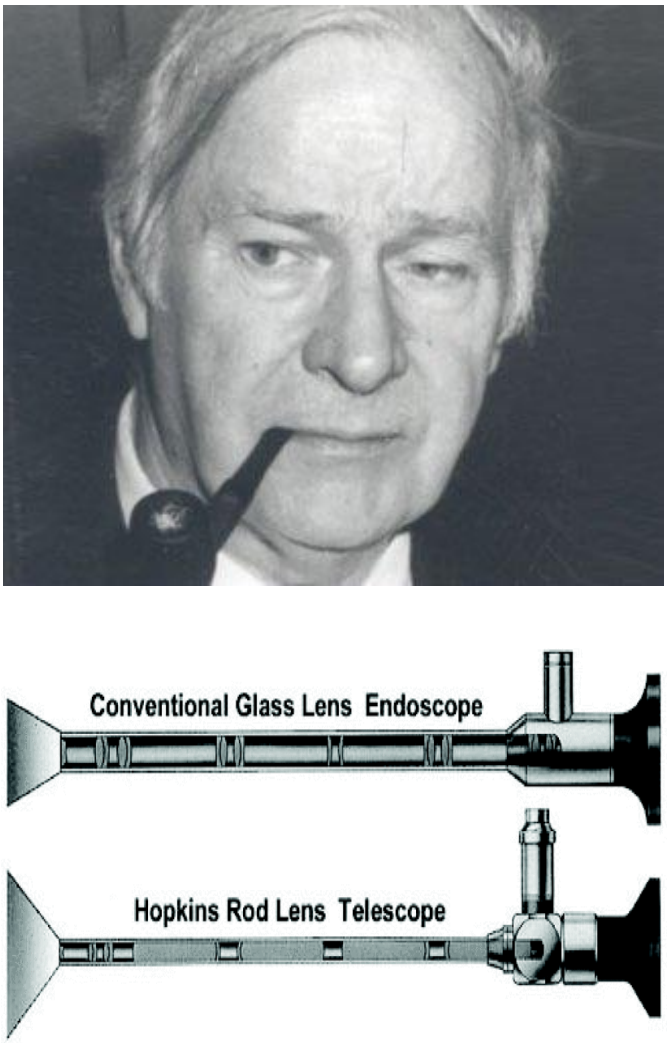


Fig 9: Harold Hopkins and the Rod lens Telescope, Adapted from Google images.

John Tyndall in 1870, was the first to describe the optical properties of glass rods, which permitted light to be guided. His work lay the foundations of flexible endoscopy. Braid and Hansell incorporated the light guiding properties of glass rods into plastic or glass fibres. These fibres were stretched to make them thin, long and flexible. In 1920, Heinrich Lamm, a medical student, suggested that optical fibre bundles might be utilized in flexible scopes(6,10). The era of flexible endoscopy began with Edward Benedict's introduction of the flexible gastroscope in 1933 in the U.S. (6,14). The early flexible scopes were flexible only distally to allow accommodation around the patient's internal anatomy and the optical systems were composed of a sophisticated series of lenses inside the scope which provided very poor image quality.

With further advancements in technology, glass-clad fibres were introduced in which each fibre had a protective coating with a lower refractive index which decreased the interface between fibres, thereby decreasing the attenuation of the image as it travels down the fibre. These technologies led to the development of the completely flexible fiber optic gastroscope in 1957, which was 0.5 inch in diameter and was invented by Hirschowitz and Curtiss(6). From then on, fibreoptic instruments have been developed for gastrointestinal applications first, and then the technology has been modified for use in the larynx and trachea.

Until the 1960s, endoscopy was generally performed in awake patients and with rigid scopes. With the advent of general anaesthesia (GA) with mechanical ventilation, endoscopy shifted from being an office procedure to an operating room procedure as it

was much better tolerated by the patient. In 1968, Swashima and Hirose were the first to describe a flexible transnasal endoscope(6,15). This marked the transition of the field of laryngology from mirror-based indirect laryngoscopy to flexible laryngopharyngoscopy; enabling office based laryngology to be practiced. The first intervention to move to office settings was injection laryngoplasty.

Chip tip technology was the next leap in the field of fibreoptic scopies. This started with the introduction of charge-coupled device (CCD) in 1969. It was incorporated into image capture devices by 1975 and this led to marked improvement in the quality of the images because of the use of dichroic beam splitter prism which devides image colours and results in better resolution and contrast. The first scope with CCD technology was introduced by Welch Allyn for Gastrointestinal applications in 1984. After miniaturization of the technology, final in 1999, the chip tip transnasal endoscope was introduced for use in laryngology(16).Transnasal scopy for otolaryngological purpose was described by Koufman in 2001using the 5.1 mm chip tip scope (6,17); and ever since this has been the method of choice for laryngeal examination in many cases.

VISUALIZATION OF THE LARYNX:

Improved understanding of vocal fold physiology and sound production along with the advancements in technology have significantly improved the otolaryngologists' ability to visualize the larynx. The examination involves a careful evaluation of the anatomic and physiologic aspects of the nasopharynx, pharynx, base of tongue and larynx.

The ideal laryngeal examination technique should assess the function of each intrinsic laryngeal muscle and the integrity of the cricoarytenoid joint, along with evaluating the phonatory function of the larynx. The examination should be non-invasive, easy to perform, inexpensive, quick and cause minimal discomfort/risk to the patient. The test should allow the patient to perform a full range of laryngeal function, allow video recording of the findings and provide means of intervention if needed.(18)

As no ideal examination method exists till date, the laryngeal examination technique should be tailored according to the patient's condition and compliance. It is therefore important to recognize the advantages and limitations of the various techniques and to choose the appropriate equipment and method to aid in optimal diagnosis. The three commonly used techniques for diagnosis are:

i) Indirect mirror laryngoscopy

ii) Direct rigid laryngoscopy

iii) Flexible transnasal laryngoscopy/ nasopharyngolaryngoscopy

INDIRECT MIRROR LARYNGOSCOPY:

The laryngeal mirror was invented by Garcia, a Spanish singing teacher in 1855; Turk and Czermak popularized its medical uses in the 1800s(8,19)

An indirect laryngoscopy requires a laryngeal mirror, external light source, 4-by-4 inch gauze pad and antifog solution.(20)

The patient is seated opposite the examiner and at a slightly elevated level with legs uncrossed. He is asked to lean forward slightly and protrude the tongue. The mirror can be warmed to just above body temperature or dipped in antifog solution or smeared to the patient's inner cheek or tongue to coat it with saliva, to prevent fogging. (18)

The anterior portion of the patient's tongue is gently grasped with a sterile 4-by-4 inch cotton gauze and held just outside the mouth. The patient is asked to take slow, deep breaths through the mouth. The light from the external light source is focused onto the oropharynx. The mirror is held at the level of the soft palate, and angled down to view the larynx and hypopharynx. Care should be taken to avoid touching the mucosa of the oral cavity, soft palate or posterior pharyngeal wall so as to avoid a gag reflex. The patient is asked to say "eee" and the dynamic motion of the true cords and the arytenoid is observed. The image in IDL appears inverted.(20)

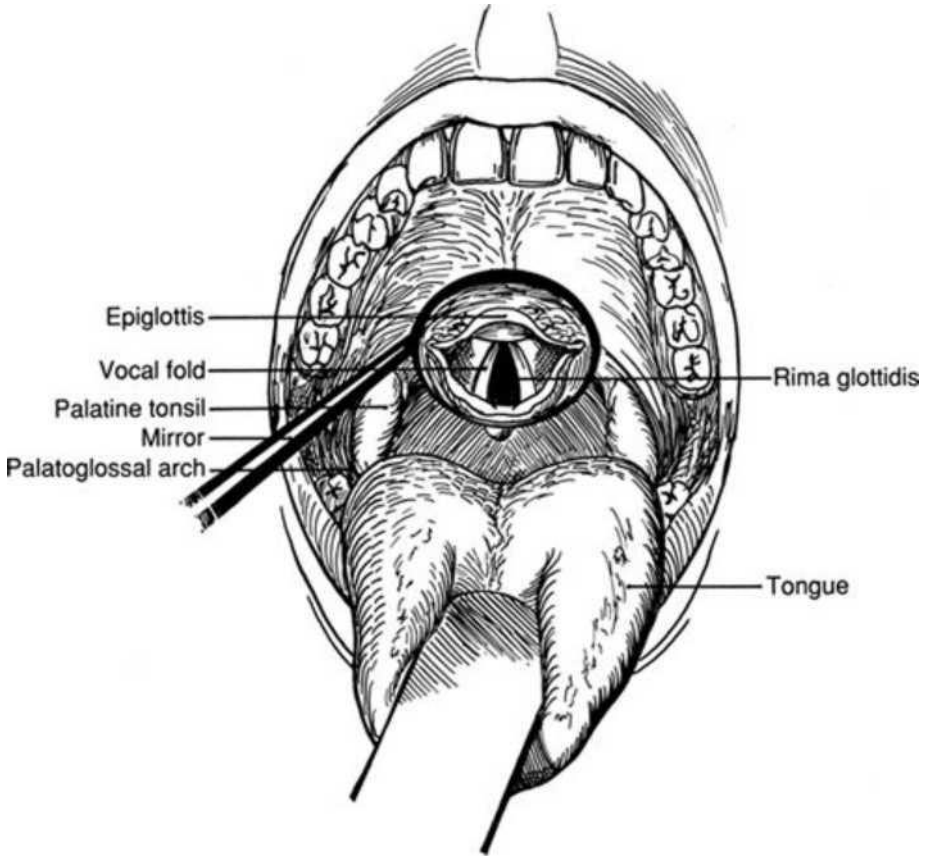


Fig 10: Indirect mirror laryngoscopy, Adapted from Google images.

The advantages of this method are that it is inexpensive, and allows a rapid, gross examination of the larynx and pharynx(21) . This method is severely limited in comparison to the newer methods, especially as a sole examination technique for patients with dysphonia. The disadvantage is that video documentation is not possible. A large base of tongue, soft palate or a hyper-reflexive gag which prevent an adequate examinationin 5% to 10% patients (21). Moreover, the examination is not performed in a normal physiologic phonation position as the tongue is extended and larynx is elevated.The patient is required to produce a higher pitch voice for optimal visualisation of the vocal cord(21).

DIRECT RIGID LARYNGOSCOPY(22,23):

This involves direct visualization of the larynx with the help of a laryngoscope and a light source for illumination. Some of the different types of scopes available are:

i) Abrahamson-Dedo scope: For venturi type ventilation

ii) Dedo: Anterior commissure scope

iii) Ossoff: Posterior commissure scope

iv) Holinger: Hour-glass anterior commissure scope

v) Jako: Laser scope

vi) Zeitels: Wide-angle scope

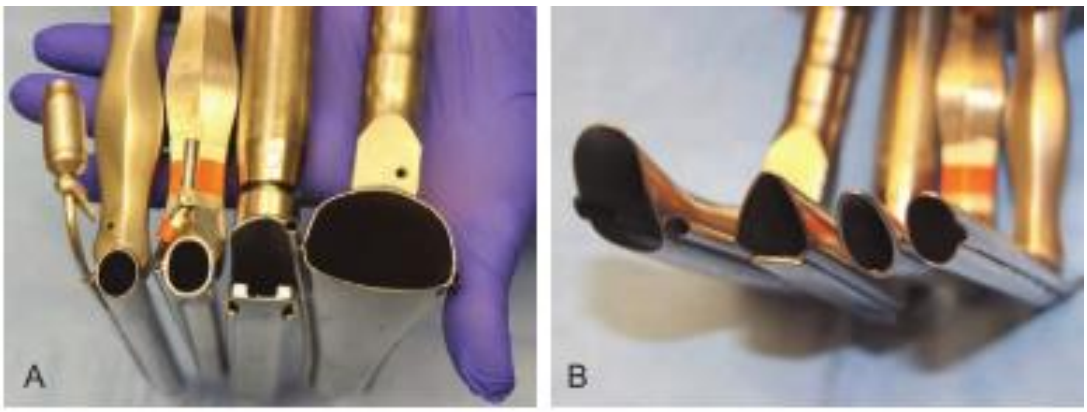


Fig 11: The viewing (left to right) and distal ends of Jackson, Hollinger, Zeitels and Bouchayer laryngoscopes, Adapted from Cummings Otolaryngology Head and Neck Surgery, 6th edition

Technique:

The patient is prepared and anaesthesized according to standard protocol. The position is supine with head extended and neck flexed in order to open the laryngeal inlet also known as the sniffing position.

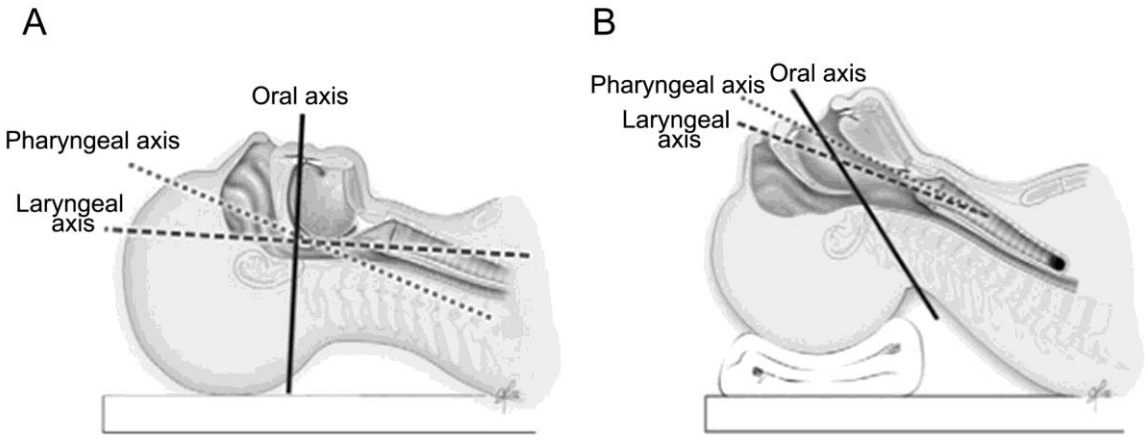


Fig 12: Classic sniffing position and 3-axes alignment theory, Adapted from Direct and indirect laryngoscopy: Equipment and techniques, Stephen R Collins MD.

The eye should be covered and dental guard be placed.The largest possible laryngoscope is selected and after adequate lubrication, is inserted into the oral cavity with care to protect the lips from injury with the non-dominant hand.

Midline is maintained while advancing the laryngoscope to identify the base of tongue, valeculla, epiglottis, posterior pharyngeal wall and arytenoids and finally the vocal cords. The larynx is fully examined by moving the laryngoscope and the larynx. The subglottis, bilateral pyriform sinus and post-cricoid region should be visulaized

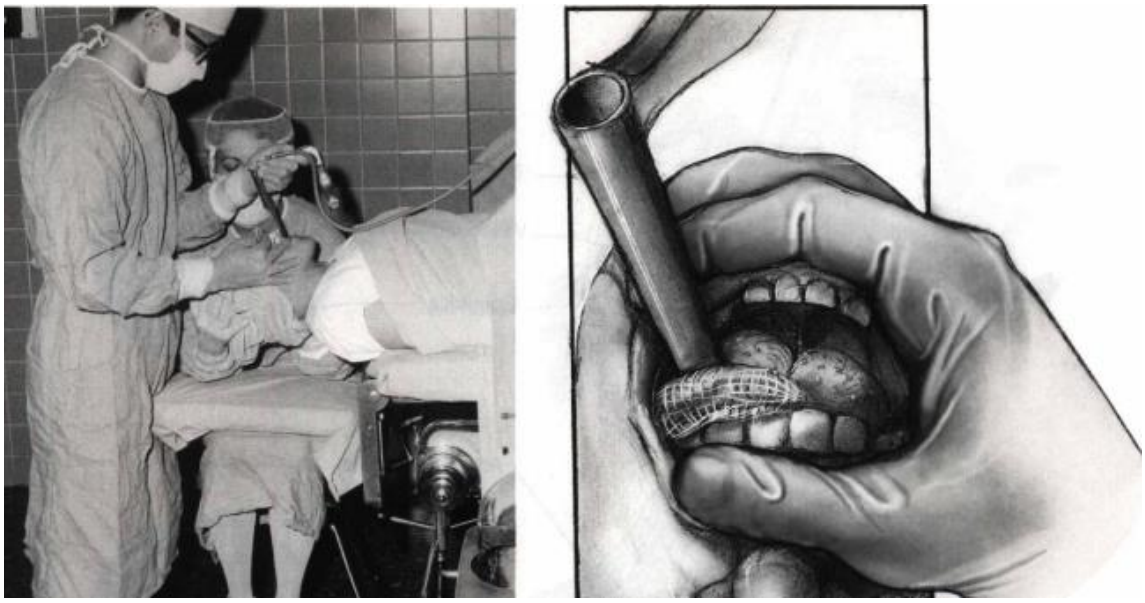


Fig 13: Direct laryngoscopy- technique, Adapted from An Atlas of Head & Neck Surgery, Vol 1 , 4th edition

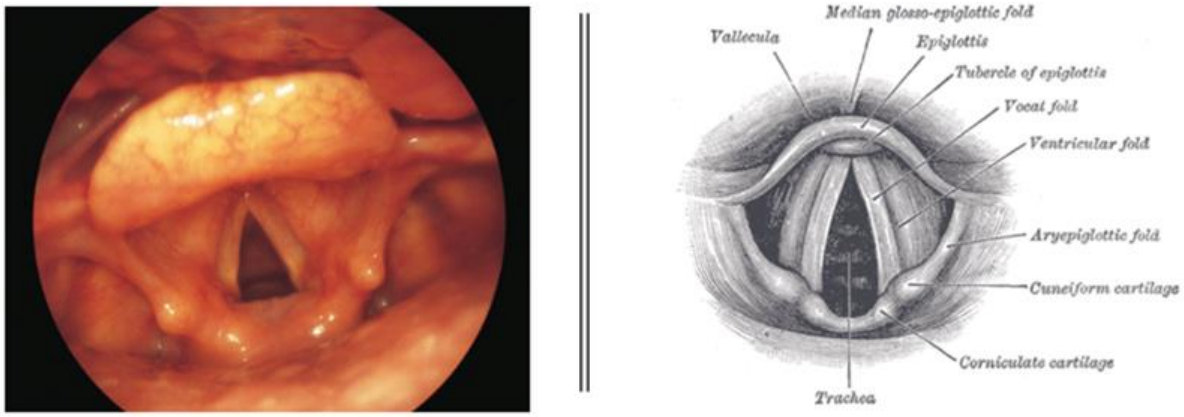


Figure 14: Direct Laryngoscopic view of Larynx and Annotated view of Larynx, Adapted from Jatin Shah's Head & Neck Surgery and Oncology, 4th ed and Google Images.

Complications that may be encountered are(23,24)

i. Mucosal injury to lips/angle of mouth

ii. Dental injury

iii. Mucosal injury to tonsillar pillars and tonsillo-lingual sulcus

iv. Subcutaneous emphysema of neck

The advantage lies in the fact that the equipment is less expensive than a flexible laryngoscope and is readily available, however the inability to perform a dynamic assessment of vocal cord limits its application(21).

FLEXIBLE NASOPHARYNGOLARYNGOSCOPY (NPL SCOPY):

The flexible laryngoscopy negates the limitations of a rigid laryngoscopy by allowing dynamic assessment of the vocal cords and its neighbouring structures, along with the added advantage of not requiring general anaesthesia. Though the instrument is costly, it is user friendly and can be easily used in an office-setting.

Fiberoptic nasopharyngolaryngoscopes, can be selected in diameters ranging from 1.9 mm to 6 mm and in adult and child lengths.

Additional equipment includes a light source, camera (which can be attached to the viewing port of the scope), a video monitor, a recording unit, and an image printer.

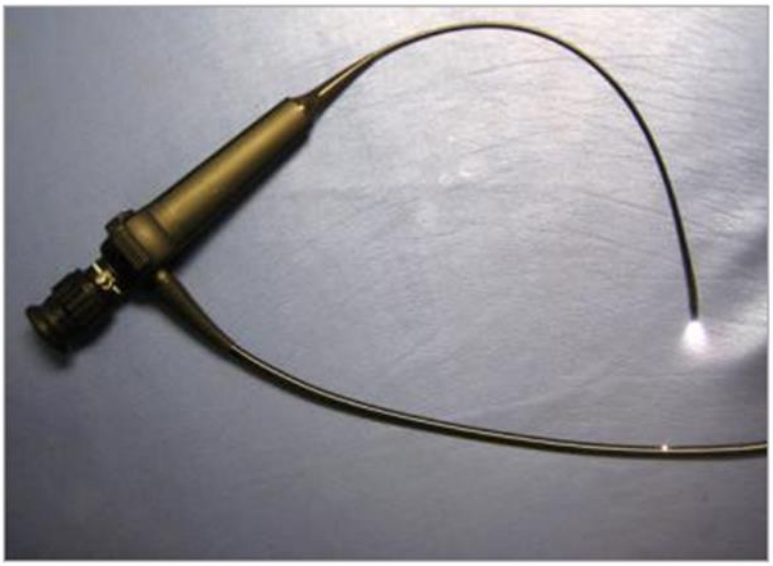


Fig 15: Adult fibreoptic nasopharyngoscope with 4-mm distal diameter, 2-way articulation and video-recording capabilities, Adapted from Medscape

The proximal end of the endoscope has an eyepiece, an angulation control lever, instrument port, focusing ring and light source adapter.

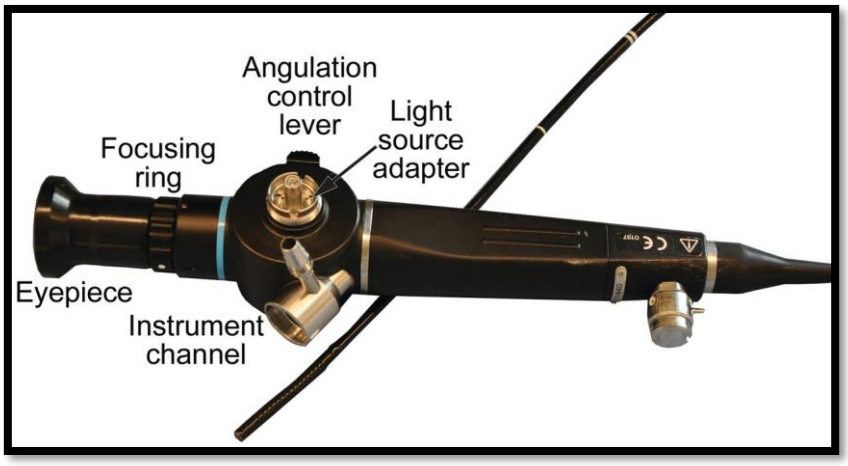


Fig 16: Parts of the NPL scope, Adapted from Google Images.

The term fibreoptic applies to a system which transmits light and images through thin fibers of optical glass by total internal reflection.

The physics of fiberoptic endoscopy(25)

When light travels through a low density medium such as air and strikes the surface of a high density medium like optical glass, a part of gets reflected back into air and a part of it crosses the interface and gets refracted in the glass. This causes a decrease in the velocity and change in direction of the refracted light.

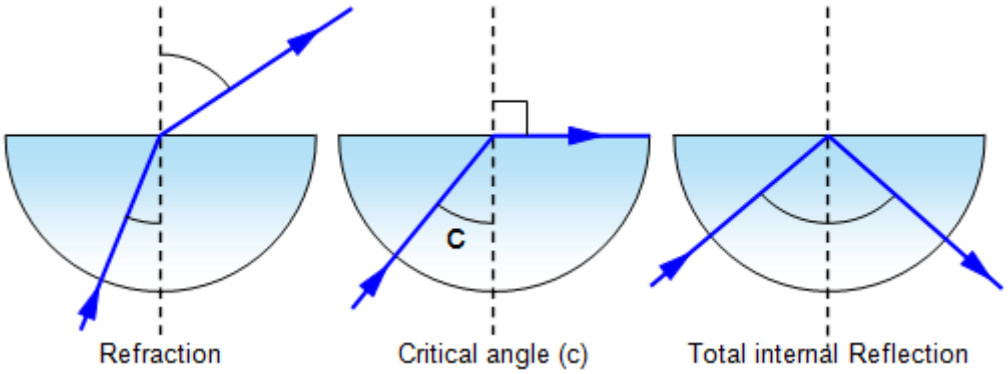


Figure 17: Reflection and refraction at air glass interface, Adapted from Google Images

As shown in the figure above, when incident angle is less than critical angle, part of light is reflected and part of it refracted. When the incident angle is equal to critical angle, part of light beam is reflected and part of it passes along the air glass interface. When the incident angle becomes greater than the critical angle, all light is reflected back at the interface. Thus, when light travels from a high density medium (glass) to a low density medium (air) all of it gets reflected at the interface when the incident angle exceeds the critical angle.

This is the concept utilized in a single optical fiber glass, wherein the refracted beam travels along the total length of the fiber by total internal reflection.

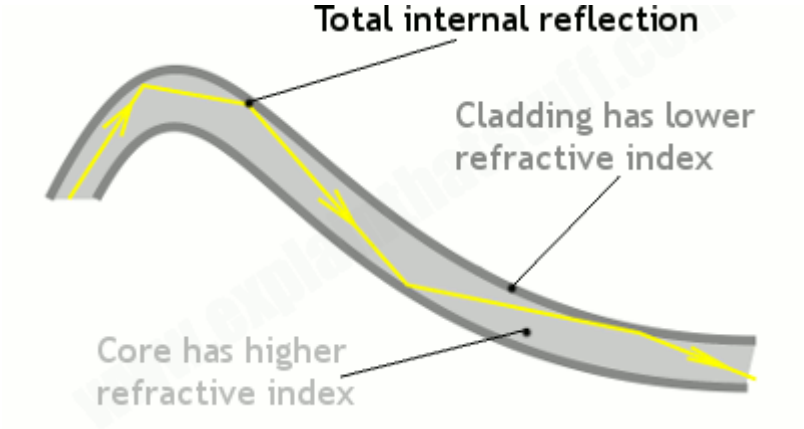


Figure 18: Light transmission through a single coated optical glass fiber, Adapted from Google Images

By coating the fibers with a thin layer of low index glass, the loss of light at the points of contact with other fibers is avoided, thereby enabling them to be placed in bundles. The fiber bundles are created by arranging them parallel to each other in the horizontal and vertical position, and with the ends of each fiber in exactly the same corresponding position at opposite ends of the bundle. This allows each end to form an image plane that would transmit the image from one end to the other.

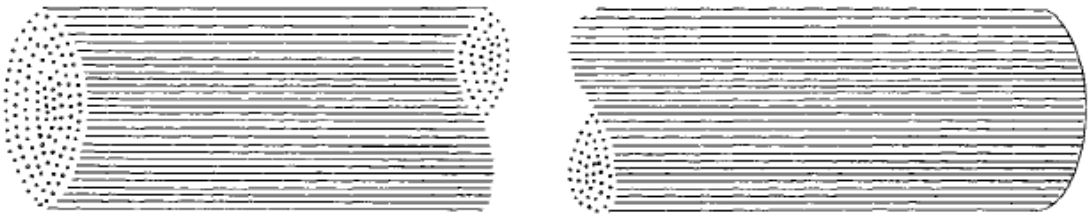


Figure 19: Enlarged view ofOptical glass fiber bundle, Adapted from Wallace FJ. Fiber Optic Endoscopy. J Urol. 1963 Sep;90(3):324–34

By placing an objective lens at one end, the image gets focussed onto the image plane; and by placing an eyepiece at the other end, the image gets transferred from the image plane to the eye. The image transmission would remain perfect even if the optical fiber bundle is bent in any direction or contour.

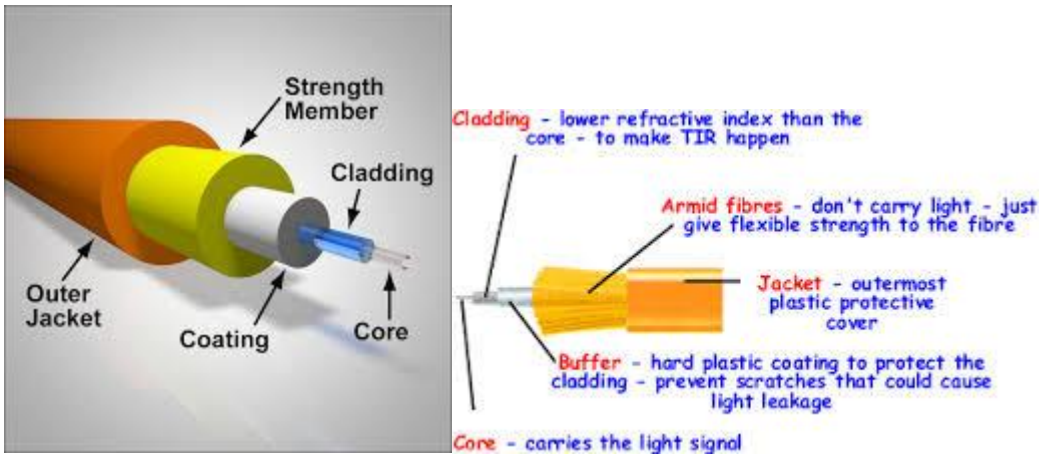


Fig 20: Annontated view of the flexible scope, Adapted from Google images.

The fibers used to form these bundles are 0.0005 inches in diameter and each of these image transmitting bundles have around 250,000 fibers. The light transmission through these bundles is very efficient, with approximately 52% light getting transmitted through a 0.225 inch diameter, 30cm long bundle.

The ability of these fiberoptic bundles to transmit high intensity light around corners and through irregular contours has been utilized in developing endoscopes to view the internal anatomy of the human body which is otherwise difficult to view. The optical fibers are made from high refractive index glass and are coated with a low refractive index glass. They are then drawn in the molten state to the desired diameter and arranged as explained earlier. The ends of the stacked bundle are polished. When attached to a high intensity light source they can transmit images of pristine quality.

The structures viewed during a routine flexible nasopharyngolaryngoscopy are:

1. Nose: Nasal turbinates and septum
2. Nasopharynx: Eustachian tube orifice, fossa of Rosenmuller and the nasopharyngeal walls.
3. Oropharynx: soft palate, uvula and base of tongue, vallecula
4. Larynx: epiglottis, aryepiglottic folds, arytenoids, false cords &true cords
5. Hypopharynx: pyriform sinus and post cricoid space
6. Subglottis

Endoscopic anatomy:

The flexible endoscope is introduced via the nostrils into the nasal cavity.

When introducing the scope, first the septum should be examined for any spurs or deviations. The turbinates and meatii on the lateral wall of the nose are examined for hypertrophy or any lesions. Any obstruction to the posterior choana should be noted.

The pharynx(10,26):

It is divided into three parts- the nasopharynx, the oropharynx and the hypopharynx.

The upper portion is called the nasopharynx which extends from the base of skull to the inferior end of the soft palate. It then transitions into the oropharynx. Posteriorly it is bounded by the upper cervical spine and anteriorly it communicates with the nasal cavity through the paired posterior choanae, which are separated by the posterior end of the nasal septum. The lateral walls of the nasopharynx are formed by the mucosa overlying the eustachian tube orifice and the bulge behind it is called the torus tubaris. The salpingopharyngeus muscle is seen in the fold of mucosa inferior to this; originating from the cartilaginous portion of the eustachian tube and inserting into the muscular layer of pharynx. At the junction of the lateral and posterior wall of the nasopharynx, and just posterior to the torus tubaris, is the space called fossa of Rosenmueller. It should be examined carefully as it is the most common site of

carcinoma nasopharynx. Adenoid tissue is mostly seen in the posterior wall of the nasopharynx in children and young adults.

The soft palate forms the boundary between the nasopharynx and oropharynx. Endoscopically, the soft palate is seen as a smooth structure sloping away from the nasal floor. If the patient is asked to say “k” the posterior surface of soft palate is pulled superiorly, making it almost horizontal so as to close the nasopharynx.Nowadays rigid nasal endoscopes are preferred for detailed examination of the nose and nasopharynx and flexible NPL is used only when rigid endoscopy cannot be done.

The anterolateral walls of the oropharynx are formed by the tonsils and its pillars. The anterior pillar is not seen in a transnasal endoscopy; but the posterior pillars can be seen. The anterior boundary is formed by the base of tongue and the posterior boundary is formed by the mucosa overlying the constrictor muscles. The mucosa of the base of tongue can appear irregular because due to the lingual tonsils.

The vallecula is an area often obscured by the epiglottis and is better visualised by asking the patient to protrude his tongue. It is bounded laterally by the lateral glossoepiglottic folds and has a median ridge of mucosa called the median glossoepiglottic fold. Small to medium sized inclusion cysts referred to as vallecular cysts may be seen here. The lingual surface of the epiglottis which is often hidden can be visualized at this juncture.

The hypopharynx lies below the oropharynx and is in close relation to the larynx and is not visualized transorally. The hypopharynx consists of the pyriform sinuses, the

post cricoid area and posterior pharyngeal walls. The pyriform sinuses end inferiorly at the level of the cricopharyngeus muscle, which serves as the valve at the superior end of the oesophagus. The inferior pharyngeal constrictors and the mucosa overlying it form the lateral and posterior pharyngeal wall.

The common variations that maybe encountered are prominent internal carotid arteries, lymphoid follicles, greater cornua of hyoid and the thyroid. The carotids might occasionally be seen as pulsatile masses posterolaterally or in the posterior pharyngeal wall. Lymphoid follicles are seen as 2-5mm, pinkish masses on the posterior pharyngeal wall. The cornua of the hyoid or thyroid becomes prominent when the patient is asked to perform Valsalva manoeuvre.

Fig 21: Prominent greater cornua of hyoid, Adapted from Laryngeal Imaging, Kendall et al.

The larynx(10,26):

It is divided into the supraglottis, the glottis, and the subglottis.

The medial boundary of the hypopharynx forms the lateral boundary of the supraglottis. The main endoscopic features of the supraglottis are the epiglottis in the midline and the aryepiglottic folds. These folds extend downward from the epiglottis to the arytenoid. It is referred to as the marginal zone as it is a common boundary between the hypopharynx. The epiglottis is a slightly curved structure, with its concave surface facing the larynx; and thus it is called the laryngeal surface of the epiglottis. Laterally the aryepiglottic folds connect it to the arytenoids. The inferior free edges of the supraglottic structures are known as the false vocal folds. The laryngeal ventricles separate the false vocal folds from the true cords. The posterior supraglottis houses the paired arytenoid cartilages and the small corniculate and cuneiform cartilages which cap them. There are two prominences on the body of the arytenoids- the muscular process and the vocal process. The muscular process is situated laterally and is not seen endoscopically; however, the vocal process, which forms the posterior attachment of the vocal fold, can be seen.

The glottis is divided into the anterior glottis and the posterior glottis. The anterior glottis is referred to as the phonatory part and the posterior as the respiratory part. The membranous vocal fold is the part of the glottis anterior to the vocal process, and it forms sixty percent of the length of the glottis. The vocal fold has 3 surfaces- superior, medial, and infraglottic. The superior surface is most accessible for examination but pathology can present on any surface and hence careful examination of all surfaces

should be done. The infraglottic surface of the vocal fold extends laterally corresponding to the underlying the conus elasticus.

The subglottis is the part of the larynx inferior to the true cords. The superior boundary has been a topic of debate, but a commonly used rule states that it lies 5 mm below the vocal fold anteriorly and 10mm posteriorly, which corresponds to the lamina of the cricoid posteriorly and its smaller size anteriorly. Posteriorly the subglottis extends to the cricotracheal junction. The subglottis is the area of the larynx with the lowest prevalence of pathology; the common being stenotic lesions, malignancy, or inflammation. To examine this area, patient co-operation is of utmost importance. Care must be taken to not touch any mucosa, which can trigger cough or gag. The scope is advanced towards the anterior commissure and then the adjustable portion of the scope is directed posteroinferiorly.

Indications of NPL scopy:

The indications of flexible nasal endoscopy can be

- Diagnostic
- Therapeutic

<u>Diagnostic indications</u>

i) Assessment of nose and nasopharyngeal pathologies

The nasal cavity and nasopharynx can also be assessed for any polyps, masses and adenoid hypertrophy.(27)

ii) Evaluation of velopharyngeal insufficiency:

When the patient counts aloud or repeats a specific phrase, the nasopharyngoscope can be used to assess the pattern of velopharyngeal closure(28). Recent studies suggest that the use of nasopharyngoscopy in addition to conventional speech therapy may help to improve velopharyngeal closure during articulation.

iii) Assessment of vocal cords for hoarseness

Hoarseness can be the presenting complaint in a number of conditions of the larynx. The common pathology that might be seen during flexible endoscopy are vocal fold nodules, polyps, papillomas, malignancy, Reinke's oedema, sulcus vocalis etc.(10,23)

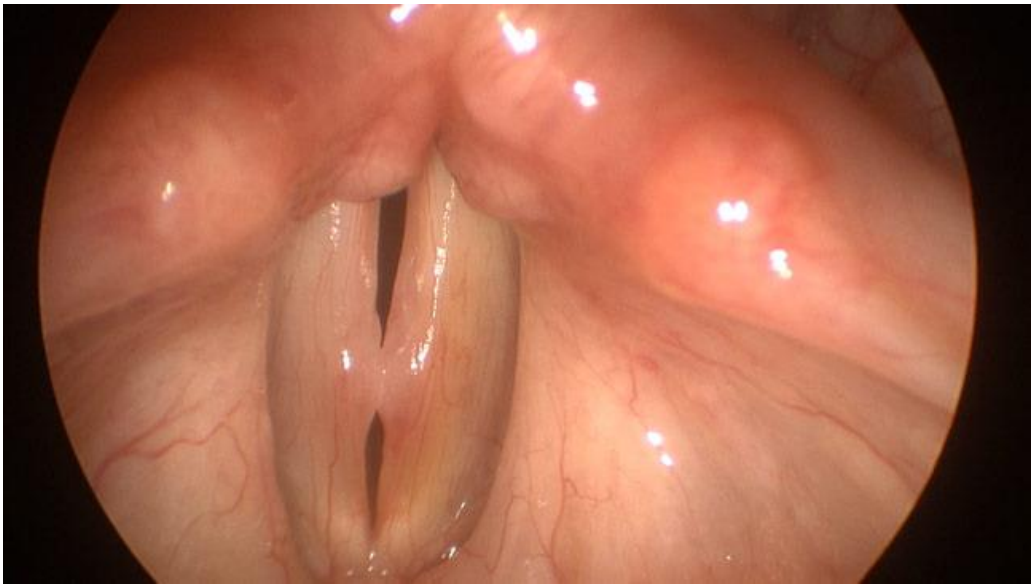


Fig 22: Bilateral vocal nodules showing hour-glass closure pattern, Adapted from Laryngeal Imaging, Kendall et al

Fig 23: Left Vocal cord haemorrhagic polyp, Adapted from Cummings Otolaryngology Head and Neck Surgery, 6th edition

Fig 24 : Left Vocal cord papilloma, Adapted from Cummings Otolaryngology Head and Neck Surgery, 6th edition

Fig 25: Reinke's edema, Adapted from Google Images

Fig 26:Sulcus Vocalis, Adapted from Laryngeal Imaging, Kendall et al

Fig 27: Malignancy Glottis T1a, Adapted from Cummings Otolaryngology Head and Neck Surgery, 6th edition

iv) Airway assessment:

It can also be used in evaluation of patients with difficult airway: in cervicofacial trauma, uncontrolled epistaxis and suspected foreign body ingestion. It may also assist in the evaluation of the severity of angioedema (29).

v) To obtain endoscopy guided biopsies(30):

The flexible endoscope with a working channel is used. After obtaining a good view of the lesion of interest, a 1.8mm flexible cup biopsy forceps is passed through the working channel by the assistant till the forceps is visible 1-2 cm beyond the tip of the endoscope. The forceps are opened and the scope is advanced till the forceps can come into contact with the lesion. The forceps are then closed and removed from the scope. Multiple biopsies

can be taken by leaving the scope at the same position till adequate sampling is obtained. The procedure is usually well tolerated by patients.

The common complications are bleeding and occasionally injury to normal vocal fold tissue.

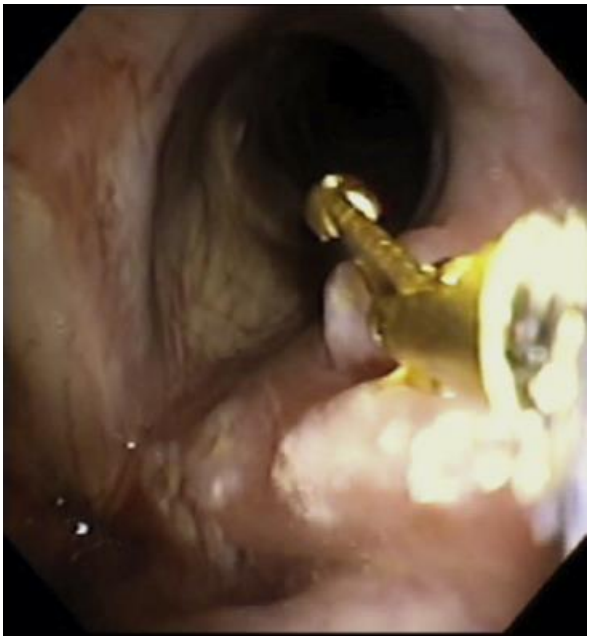


Figure 28: A true vocal cord lesion being biopsied using a flexible biopsy forceps passed through the working channel of a flexible scope, Adapted from Shah MD, Johns MM. Office-based laryngeal procedures. Otolaryngol Clin North Am. 2013 Feb;46(1):75–84.

vi) To detect lesions in the upper aerodigestive tract(23)

Malignant and benign conditions of the nasopharynx, oropharynx, hypopharynx and larynx can be detected and documentation of the same can be done.

Fig 29: Malignancy Supraglottis, Adapted from Cummings Otolaryngology Head and Neck Surgery, 6th edition

Fig 30: Malignancy Right pyriform sinus, Adapted from Google Images

Fig 31: Malignancy Postcricoid region, Adapted from Google Images

vii) Functional endoscopic evaluation of swallowing

Fiberoptic endoscopic evaluation of swallowing (FEES) has emerged as a comparable alternative to video fluoroscopy and modified barium swallow in the evaluation of dysphagia(31). It was first described by Langmore et al in 1988(32,33). The procedure is ideally done with the patient in seated position, unreclined and awake. By visualizing the pharynx during swallowing, the patient can be assessed for delays in swallowing, laryngeal penetration, aspiration, and pharyngeal residue after swallowing. The use of topical nasal anesthesia is currently controversial for this procedure owing to concern for the risk of desensitizing the pharyngeal or laryngopharyngeal mucosa, which would thereby skew results. However, current American Speech-Language-Hearing Association (ASHA) guidelines allow physicians to choose its use(32). The equipment needed is a flexible

laryngoscope with a halogen or xenon light source. A complete examination involves examination of the anatomy at rest and during movement, the accumulated oropharyngeal secretion level and bolus flow of various liquids and solids during swallowing. After noting the anatomy or rather any pathology in the anatomy, the pharyngeal squeeze manoeuvre is performed(34). This involves asking the patient to make high-pitched, strained voice, preferably in a raising crescendo. In a normal person, this will result in recruitment of the pharyngeal constrictor muscles. This serves as a reasonable surrogate for pharyngeal motor strength(35,36). Before presentation of any food, any amount of secretion in the laryngopharynx should be observed and quantified as follows(37):

Secretion Level	Description
Level 1: functional level	No endolaryngeal secretions present. The accumulation/pooling of pharyngeal secretions may range from none/minimal to >25% in the pyriform sinuses or vallecular space
Level 2: severe level	Endolaryngeal secretions are present. Laryngeal penetration of secretions above the level of the true vocal cords; intermittent laryngeal penetration of secretions on inhalation; but no aspiration of secretions observed
Level 3: profound level	Secretions present at or below the level of the vocal cords

Fig 32: Secretion severity scale, Adapted from Brady S, Donzelli J. The Modified Barium Swallow and the Functional Endoscopic Evaluation of Swallowing. Otolaryngol Clin North Am. 2013 Dec 1;46(6):1009–22.

After this, food is presented to the patient. Food colouring can be used but is not mandatory(34,38). Initially water or ice chips are given, if the patient does well on these then pureed consistencies and crackers or pretzels are presented. The presence of aspiration or penetration should be noted. Any vallecular, pharyngeal wall or pyriform sinus residue also should be noted.

FEES is limited by the fact that the oral phase of swallowing is not assessed and in this regard the modified barium swallow is superior to it(34).

Sensory testing can be combined with FEES and it is then known as flexible endoscopic evaluation of swallowing with sensory testing (FEESST). It was first described by Aviv et al(32,39). The basic concept of this test is that stimulation of the supraglottis (with a small puff of air) elicits the laryngeal adductor reflex (LAR); which is a brisk closure of the larynx and can be easily identified. The response is noted on both sides and is quantified at various levels of air-puff pressure.(34)

viii) Evaluation of obstructive sleep apnea

The Müller manoeuvre can help identify patients who could benefit from surgery. The patient should forcefully inspire against a closed nose and mouth, thereby evoking retropalatal collapse. However, these findings are not clearly correlated with the need for surgical intervention, and the subject remains controversial(40,41).

Sleep nasendoscopy was first described by Croft and Pringle in 1991. Keziran and Hohenhorst changed it to " drug-induced sleep endoscopy" (DISE)(42). The three key features of this method are:

- Use of pharmacologic agents to achieve sedation.
- Target depth of sedation as approximating natural sleep as possible.
- Endoscopic evaluation of upper airway during this period.

The sedative agent is generally administered intravenously at the minimum dose to achieve the desired depth of sedation, i.e, loss of response to verbal

stimuli at normal conversational volume. The drugs commonly used for the procedure are Propofol, midazolam, dexmedetomidine or a combination of Propofol and midazolam.

The endoscopic examination is mainly an assessment of the pharynx, which is achieved by moving the scope a number of times to evaluate the entire length of the pharynx during cycles of airway obstruction and normal breathing. The VOTE classification is used as standard for DISE grading(42). This involves grading the level of obstruction at the 4 major structures which cause airway obstruction in most patients: Velum(palate), oropharyngeal lateral walls including tonsils, tongue and epiglottis. The level of obstruction is graded as:

- None: No vibration of involved structure and <50% airway narrowing as compared to normal breathing.
- Partial: Vibration and 50-75% airway narrowing
- Complete: Obstruction and >75% airway narrowing

ix) Stroboscopy(43):

Oertel developed the first stroboscope in 1895, but the procedure gained wideapread acceptance only in the later part of the 20th century.

Stroboscopy uses a pulsed light source as opposed to continuous light examination in laryngoscopy with either a rigid or a flexible endoscope. It is extremely useful when the normal laryngeal examination with continuous light does not explain the severity of patient's complaint. The light pulses are at a frequency slightly different from that of the glottic cycle, thus

generating a series of still images of the vocal fold at different points of the glottic cycle. These images are then fused into an apparent continuous sequence and can be observed by the examiner(44).

Fig 33: Persistent glottic opening seen in significant presbyphonia, Adapted from Laryngeal imaging, Kendall et al

x) Narrow band imaging:

Squamous dysplasia and carcinoma in situ of the upper aerodigestive tract is very difficult to detect by routine endoscopic examination. Narrow band imaging is a novel technique for visualizing mucosal surfaces using narrow bands or selected portions of the light spectrum. In general the long wavelengths(red) diffuse deeper, whereas the short wavelengths (blue) diffuse superficially. Also, the blue spectrum corresponds to the peak

absorption of hemoglobin, thus any abnormal superficial blood vessels or angiogenesis will appear darker and more obvious. The procedure can be easily done in the out-patient setting ,using appropriate light filters in conjunction with flexible laryngoscopy(45,46).

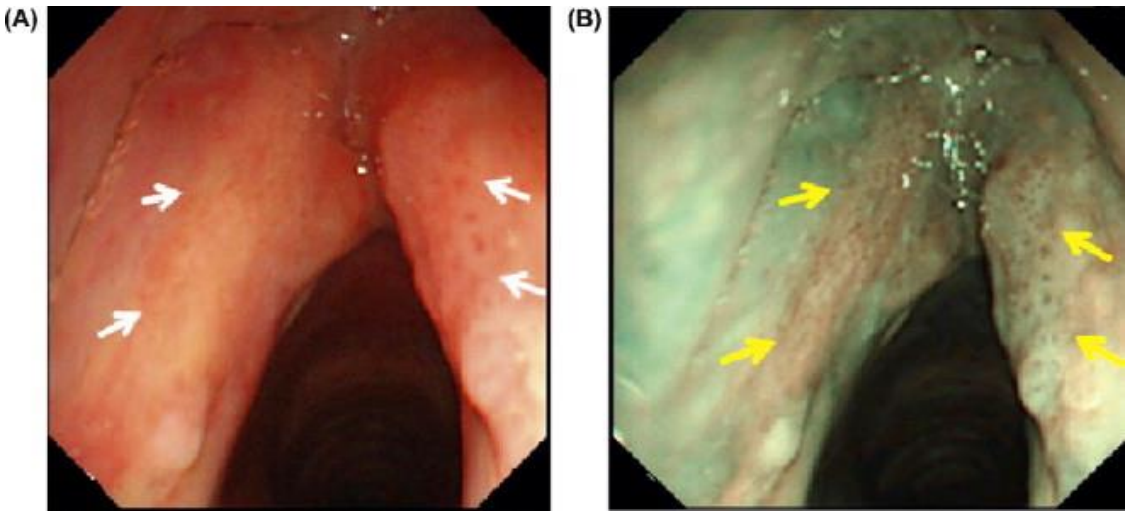


Fig 34: Narrow band imaging, Adapted from Google Images

xi) Optical coherence tomography- OCT(47–49):

It is an innovation in the field of optical imaging technique which provides high resolution images (~10 to 20um), cross-sectional images of microscopic subsurface structures. The images are generated by measuring the intensity of the scattered back light after probing the tissue with a low-power, near-infrared source of light. Interferometric methods are used to detect light that gets reflected back from tissue, which is used to create a 2-dimensional image. The image formed is similar to a vertical histologic section. The OCT system can be used to scan tissue in a linear, transverse or radial fashion and can be easily interfaced with endoscopes, catheters, laproscopes etc. It provides information about the thickness of the

epithelium, integrity of basement membrane and the structure of lamina propria. This can be very useful in the detection of early glottic malignancies and premalignant conditions. It can also differentiate scar tissue and inflammation from malignant conditions. Thus, directed biopsies can be obtained.

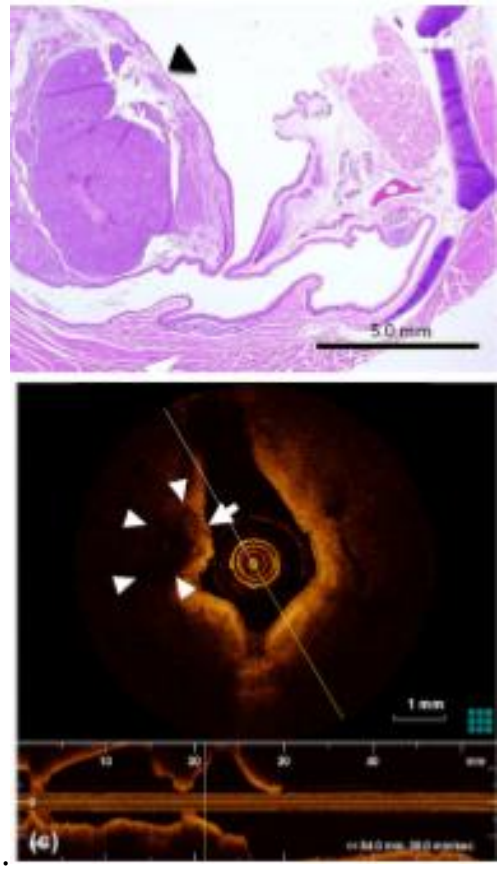


Fig 35: OCT image showing intact basement membrane and lamina propria, and tumour deeper to it, Findings confirmed on histology. Adapted from Oak C et al. Multimodal imaging using optical coherence tomography and endolaryngeal ultrasonography in a new rabbit VX2 laryngeal cancer model. Lasers Surg Med. 2015 Sep 9;47.

Therapeutic indications:

i) Office based injection laryngoplasty:

This is mainly done for unilateral vocal fold paralysis. Medialization of the paralyzed vocal cord to facilitate glottic closure remains the mainstay of the surgical treatment. Injection medialization of the vocal cord was first performed by Brunings in 1911 using paraffin via peroral route(50,51).

Office-based procedures can be done via transcervical or transoral technique. The injection material is primed through the tubing of a 23 or 25-gauge flexible needle, and is then introduced through the working channel of the flexible scope till it can be seen beyond the tip of the laryngoscope. The length of the needle extending beyond the endoscope can be varied depending on the surgeon's preference and the laryngoscope can then be used to direct the needle to the desired position(52,53). The injection must be placed in the paraglottic space or the medial/lateral aspect of thyroarytenoid muscle. The paraglottic space is the space between the conus elasticus and vocal ligament medially and inner perichondrium of thyroid/cricoid cartilages laterally. A volume of ~ 0.76ml can be injected(50,54). "Stair stepping" of the injection path so that the entry site into the mucosa doesn't align with entry site in the vocal ligament has been suggested so as to minimize extrusion through the injection site. The most commonly used materials for awake injections are methylcellulose, bovine collagen and calcium hydroxylapatite.

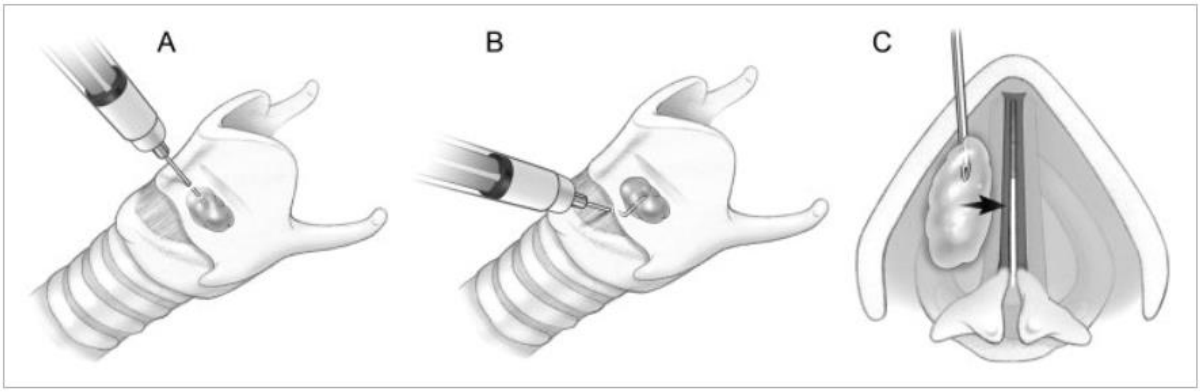


Fig 36: (**a**) Percutaneous injection laryngoplasty—transthyroid ala approach. (**b**) Percutaneous injection laryngoplasty—subthyroid ala approach. (**c**) Delivery of collagen into paraglottic space, Adapted from Damrose EJ. Percutaneous injection laryngoplasty in the management of acute vocal fold paralysis. The Laryngoscope. 2010 Aug 1;120(8):1582–90.

ii) Percutaneous tracheostomy:

Percutaneous dilational tracheostomy was a technique first described in 1995 by Sheldon et al.(55,56). Since then the technique has greatly advanced and is now being used in many hospitals as bedside procedures. The initial steps are similar to open tracheostomy. Using a 15 blade scalpel, a horizontal incision 1-1.5cm is made approximately 2 fingerbreadths below the cricoid or 1 fingerbreadth above the sternal notch. Blunt dissection is done to palpate the cricoid cartilage and tracheal rings. A flexible laryngoscope or bronchoscope with a suction port is introduced via the endotracheal tube(ETT) till the tip is flush with that of the endotracheal tube. The ETT and the scope is withdrawn to visualize the incision site.

A 16-gauge Teflon introducer needle is now inserted between the first and second or second and third tracheal rings. The needle is withdrawn and a J-tipped guidewire is advanced through the outer sheath of the introducer. Serial dilation is then performed. The tracheostomy tube which is prefitted with an appropriately sized loading dilator is threaded over the guidewire and inserted into the trachea. The whole procedure is visualized via an endoscope and reduces technical difficulties of the procedureand complications like accidental extubation, false passage creation, pneumothorax, pneumomediastinum. The disadvantage is that endoscopy adds extra cost, time and can cause difficulty in ventilating patient and CO2 retention.(56)

iii) Fiberoptic intubation(57):

The most common indication is an anticipated difficult intubation or when there's airway compromise because of upper airway pathology. It has also been recommended in patients with unstable cervical spine and those with high risk of dental damage. The intubation tube is mounted over the insertion cord of the flexible scope before beginning the procedure. The procedure can be performed in awake patients as well as after induction of general anesthesia.

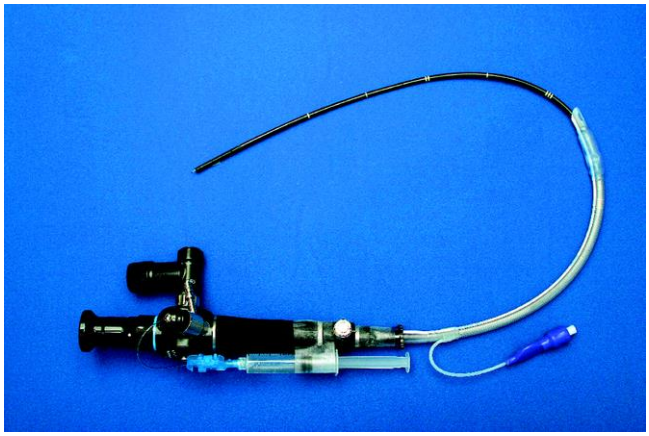


Fig 37: Fibreoptic intubating videolaryngoscope, Adapted from Google images.

Contraindications of flexible laryngoscopy:

Nasopharyngoscopy is considered a very safe procedure with few contraindications and complications in experienced hands.

Relative contraindications include coagulopathies that might result in significant bleeding if even minor trauma occurs during the procedure. In the setting of craniofacial trauma, the benefits should be carefully weighed against the risks of inadvertent intracranial instrumentation and exacerbation of nasopharyngeal injuries. Epiglottitis can also be considered as a relative contraindication in view of impending airway compromise(20).

Positioning:

All patients being examined should be seated with the head extended forward and the neck flexed on the chest (sniffing position) to bring the pharynx and larynx into alignment. A headrest should be used to stabilize the head. Orientation of the distal tip of the endoscope can be controlled with the index finger or thumb through a switch. The dominant hand should hold the scope while the non-dominant hand can be used to stabilize the scope by resting it on the patient's nose or cheek.

The examination can also be done with the patient in supine position. If this position is used, the clinician should be standing at the head end of the patient, a little to left of midline with similar endoscopic control as described above. In this position, however, the visualization of structures caudal to the nasopharynx is poor because the tongue falls back.

Technique(20):

The tip of the NPL scope is placed in the most accomodating nostril and carefully advanced lateral to the septum and medial to the inferior turbinate, along the nasal floor. The scope is advanced posteriorly beyond the middle turbinate to visualize the eustachian tube orifice which is located lateral to the entrance of nasopharynx. The shallow depression just posterior to the eustachian tube orifice is the fossa of Rosenmuller, which should be examined carefully, because of the predilection to nasopharyngeal carcinoma. The posterior part of the nasal septum, the nasopharygeal part of soft palate and the roof of nasopharynx should be examined.

The patient is asked to breathe through the nose, to separate the palate from the posterior nasal wall and enable passage of the scope into the oropharynx. The scope is directed downwards to give a panoramic view of the oropharynx. The palatine tonsils can be seen laterally along the palatopharyngeal arches and the base of tongue and the lingual tonsil can be seen in the midline. The scope is passed further down to view the epiglottis and the vallecula. When directing the tip of the scope posteriorly, the laryngeal surface of epiglottis, arytenoids, aryepiglottic folds, false vocal folds, true vocal cords, and pyriform sinus are visualized. The true cords appear white and taut; any change in the mucosal colour or any superficial irregularities should be noted.

With deep breathing the cords are abducted and the glottis remains open; the patient can be asked to sniff or inspire deeply through the nose to cause maximal vocal cord abduction so as to allow optimal laryngeal examination(58). To assess the function and movement of the cords and the arytenoid cartilages, the patient is asked to say “e” or “ah”. The subglottis can also be usually seen just below the true cords. The scope should not be passed through the true cords as this can elicit laryngospasm. The hypopharyngeal region should also be examined closely to rule out any abnormalities.

There are many maneuvers that have been described to help in better visualization of the above structures and facilitate the advancement of the scope. These are:

- For soft palate visualization: Gentle nose breathing
- For vallecula visualization: Tongue protrusion

- For visualization of hypopharynx:

i) The head torsion technique(59):

The patient's head is turned to the side which needs to be observed in detail. This gives a clear view of the inferior surface of the vocal fold and the ventricles of the same side and a better visualization of the pyriform sinus of the opposite side.

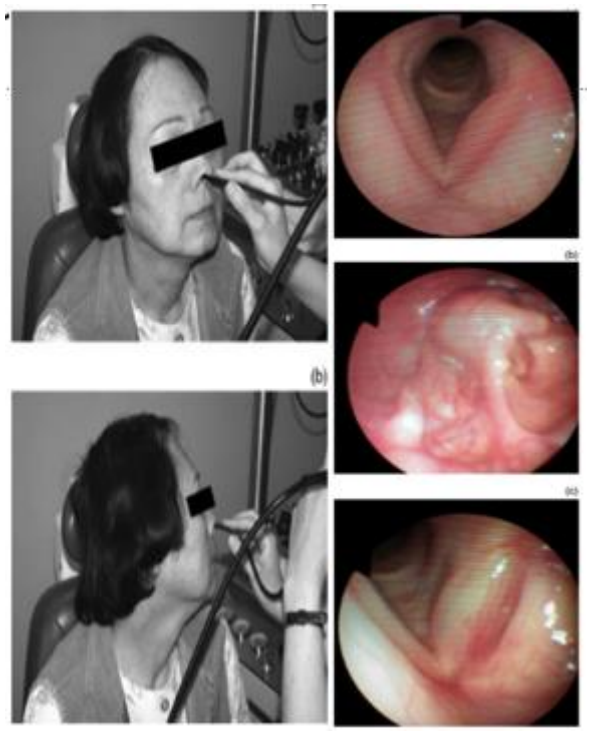


Fig 38: Head torsion technique and the corresponding laryngoscopic images, Adapted from Tsunoda A et al Head torsion technique for detailed observation of larynx and hypopharynx. J Laryngol Amp Otol. 2007 May;121(5):489–90.

i) Valsalva manoeuvre(60):

The patient is asked to blow with their mouth closed. This provides better view of the pyriform sinus and post-cricoid area.

ii) Trumpet manoeuvre(61,62)

The patient is asked to keep his index finger between his lips and blow as hard as possible, as though trying to inflate a balloon. This causes the larynx to get elevated and the pyriform sinus and post-cricoid areas to be better visualized.

iii) Anterior neck traction(44,62)

While performing the endoscopic examination, anterior neck skin traction is given and the patient is asked to perform Valsalva. This enables better visualization of the hypopharynx.

Fig 39: Anterior neck skin traction and the corresponding laryngoscopic images, Adapted from Ni X-G, Cheng R-R, Lai S-Q, Zhang L, He S, Zhang Y-M, et al. Novel laryngoscopic strategies to improve evaluation of the site and extent of primary hypopharyngeal tumours. J Laryngol Amp Otol. 2013 Sep;127(9):882–9.

iv) Modified Killian method(63,64):

This was first described in 2014.

- The patients neck is bent forward and the chin depressed far enough for the patient to look at his umbilicus. This is the Killian position.
- In the modified Killian position, the patient is further bent forward from this position, as if bowing.

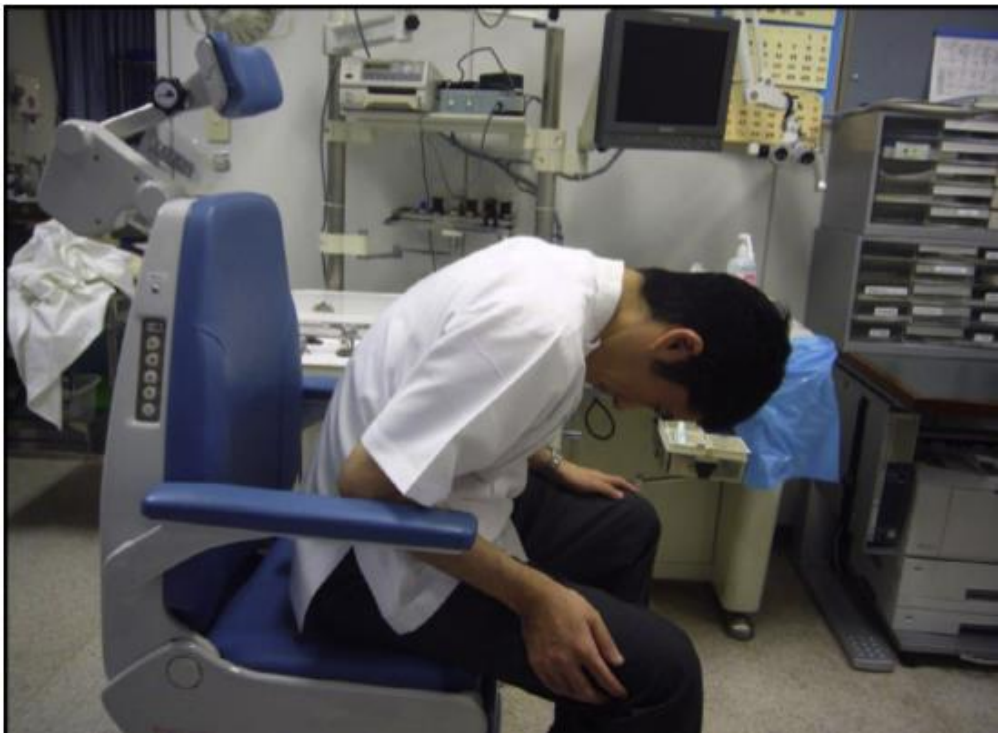


Fig 40: The modified Killian position, Adapted fromSakai A, Okami K, Sugimoto R, Ebisumoto K, Yamamoto H, Maki D, et al. A new technique to expose the hypopharyngeal space: The modified Killian's method. Auris Nasus Larynx. 2014 Apr;41(2):207–10.

- With the patient in this position, the head is turned to either side and is asked to perform Valsalva manoeuvre. This combination of modified Killian position, head torsion and Valsalva manoeuvre constitutes the modified Killian method.

-

Fig 41: The modified Killian method, Adapted fromSakai A, Okami K, Sugimoto R, Ebisumoto K, Yamamoto H, Maki D, et al. A new technique to expose the hypopharyngeal space: The modified Killian's method. Auris Nasus Larynx. 2014 Apr;41(2):207–10.

- This method has shown to give a clearer view of the entire circumference of the hypopharyngeal space and the cervical oesophageal entry; thus becoming an indispensable technique in identifying lesions of the hypopharynx.

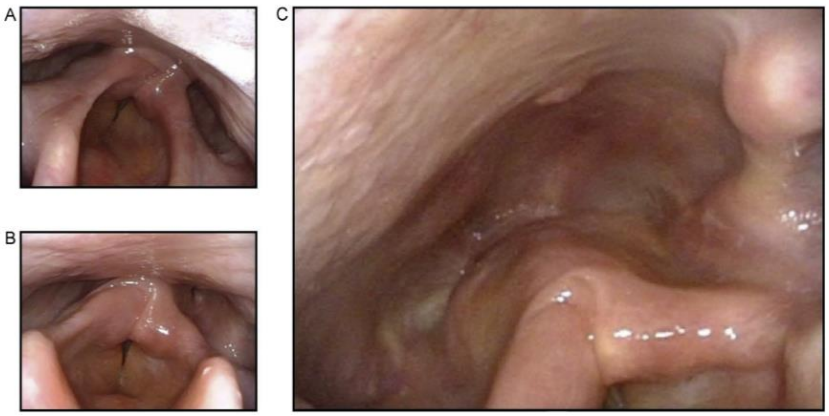


Fig 42: Fiberoptic findings with (A) normal position, (B) with Valsalva manoeuvre and (C) with the MK method; Adapted fromSakai A, Okami K, Sugimoto R, Ebisumoto K, Yamamoto H, Maki D, et al. A new technique to expose the hypopharyngeal space: The modified Killian's method. Auris Nasus Larynx. 2014 Apr;41(2):207–10.

- For visualization of subglottis(65)

  After advancement of the scope till just above the glottis, the patient is asked to place his chin on the chest, while continuing to breathe through the nose. When done correctly, this provides clear view of the lateral and posterior subglottis.

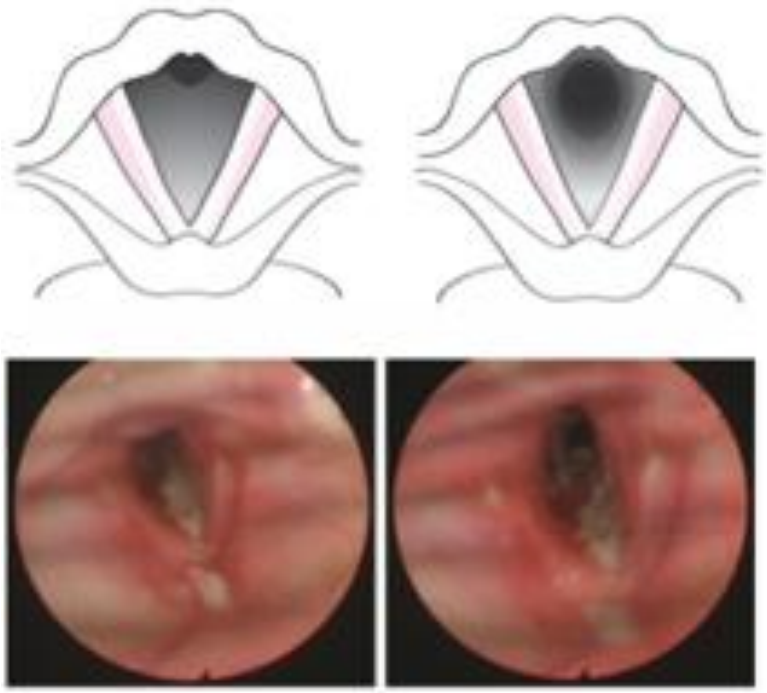


Fig 43: Fiberoptic findings with with normal position and while doing the manouvre; Adapted from Cherko M, Ghufoor K. A manoeuvre to enhance subglottic view during flexible laryngoscopy. Clin Otolaryngol Off J ENT-UK Off J Neth Soc Oto-Rhino-Laryngol Cervico-Facial Surg. 2016 Aug;41(4):437–8.

Cleaning and disinfection of endoscopes(66):

After use, the endoscopes must be thoroughly cleaned with water and detergent. Air is expelled from all channels and the scope is bathed in 2% glutaraldehyde solution. This is noncorrosive to rubbers, plastics and metals and destroys bacteria and viruses within 4 minutes. The disinfection time is 20 mins at 20^{0} centigrade. Other agents that can be employed for disinfection are alcohol, chlorine dioxide, peracetic acid and Cidex OPA(0.55% ortho-phthaldehyde).(67,68) Cidex OPA is being used as an

alternative agent to 2% glutaraldehyde as it is fast acting High-level disinfectant and does not cause respiratory irritation when compared to glutaraldehyde(68)

Complications of flexible laryngoscopy:

The complications of the procedure are uncommon, the usual ones being tearing, coughing and occasional epistaxis. Rarely there can be transient laryngospasm, vasovagal syncope and residual foreign body sensation. The incidences of desaturation and laryngospasm are more common in the pediatric population(69).

NASAL PREPARATION PRIOR TO ENDOSCOPY

Flexible nasopharyngolaryngoscopy is done after achieving adequate analgesia so as to cause minimal patient discomfort. The choice of anaesthesia depends on the expertise of the endoscopist, the patient compliance, the duration and nature of the procedure. Traditionally a topical anaesthetic has been used in the nose prior to examining the upper aerodigestive track. It is believed that this reduces patient discomfort during examination and improves the adequacy of examination. The various forms of anaesthetic agent used are local anaesthetics or local anaesthetic with decongestants. These agents can be topically applied to the nasal cavity as sprays, gels, pastes, creams or pledgets soaked with the agent(1,70,71)

There are however no clear guidelines as to which mode of application is the best or whether any anaesthetic is needed at all(2,3).

Pain (which is a noxious stimuli) anywhere in the body is detectedby the free nerve endings of primary afferent C type fibers and Aδ fibers. The inflammatory mediators (like serotonin, bradykinins, cytokines, prostaglandins etc.), which are released from damaged tissue, can stimulate these fibers directly and cause reduction in the activation threshold of these fibers, thereby causing reduced tolerance to pain.

These fibers then synapse with secondary afferent neurons in the dorsal horn of the spinal cord, and the sensation are finally carried by the spinothalamic tract and spinoreticular tract to the somatosensory cortex in the brain.

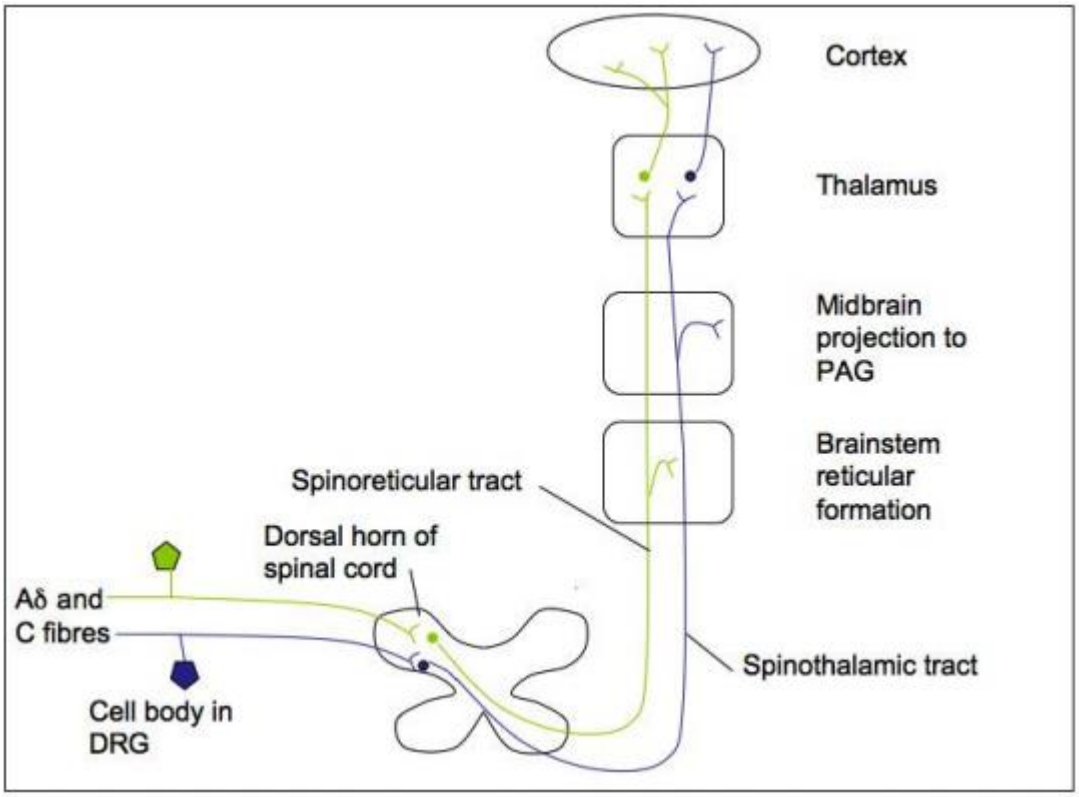


Fig 44: Pain pathway, Adapted from Google images.

The agents commonly used for this purpose are:

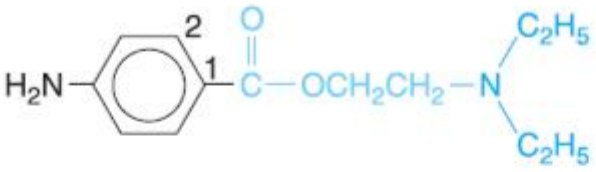
Local anaesthetics:

These are drugs that bind reversibly to specific receptor site in the pore of the sodium channels located in the nerves, thereby blocking ion movement in the pore. When the agent is applied in appropriate concentrations, it can act on every part of the nervous system, irrespective of the type of nerve fiber. It causes both motor and sensory paralysis in the area innervated by the nerve. The effect of the drug is reversible with recovery of nerve function, without any damage to nerve fibers, when used in the clinically recommended dose.

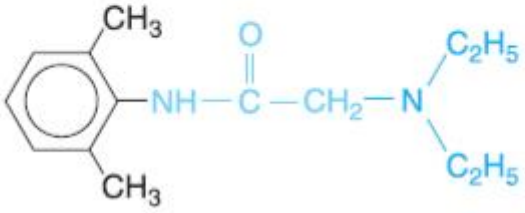
These drugs have an aromatic and an amine group separated by an intermediate group. Based on this they are divided into two groups:

a. Esters- these have an ester link between the intermediate group and the aromatic portion. Examples are: Tetracaine, Benzocaine, Procaine

b. Amides: These have an amide link between the intermediate group and the aromatic portion. Examples are: Lidocaine, Bupivacaine, Prilocaine, Etidocaine, Mepivacaine.



PROCAINE



LIDOCAINE

Fig 45: Structure of Procaine and Lidocaine, Adapted from Goodman & Gilman's Manual of Pharmacology and therapeutics

Mechanism of action:

These drugs block conduction by preventing the large transient increase in permeability to sodium ions of excitable membranes, which normally occurs by a slight depolarization of the membrane. These agents interact directly with voltage gated Na+ channels to block conduction across these reversibly.

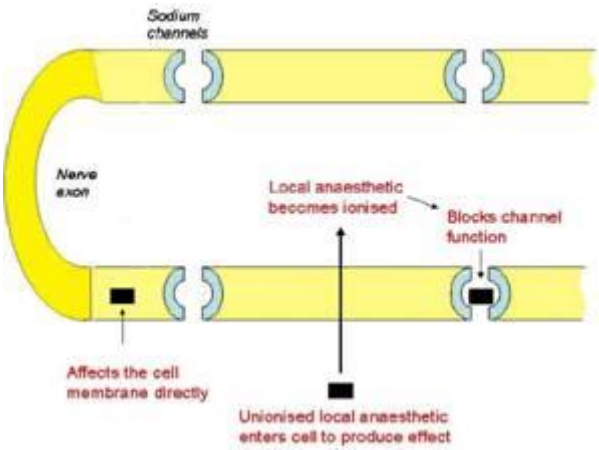


Fig 46: Mechanism of action of local anaesthetics, Adapted from Google images.

The action is dependent on the type of nerve fiber and frequency of stimulation. Small unmyelinated C fibers (which mediate pain), autonomic fibers and small myelinated Aδ fibers get blocked before the larger myelinated Aγ, Aβ and Aα fibers (which mediate touch, position, pressure and motor information). Also, a resting nerve is much less sensitive to the action of local anaesthetic than a nerve which is repeatedly stimulated; thus, higher frequency of stimulation and a higher positive resting membrane potential cause a greater degree of anaesthetic blockage.

Prolongation of action by using vasoconstrictors:

The duration of action of local anaesthetics is directly proportional to the time of contact with the nerve fiber. Catecholamines which act on α-adrenergic receptors cause vasoconstriction, thereby reducing absorption of local anaesthetics and prolonging their duration of action. So, in clinical practice a vasoconstrictor, mostly adrenaline, is added to the local anaesthetics. The only disadvantage of this is that the systemic side effects of the local anesthetics is increased because of deposition in skeletal beds (β2 adrenergic action causes dilation of vascular bed in skeletal muscles).

Side effects of local anaesthetics:

These effects are due to systemic absorption of these agents, and the danger of such reactions is proportional to the concentration of drug in systemic circulation.

a. CNS: Drowsiness is the most common side effect. There is suppression of inhibitory neurons which causes CNS stimulation and can lead to restlessness and tremors which can progress to clonic convulsions. In later

stages of intoxication, there is CNS depression and death due to respiratory failure.

b. CVS: These agents cause decrease in excitability, conduction rate and force of contraction, usually due to accidental direct intravascular injection, especially if adrenaline is also present. The CVS effects usually occur after high systemic concentrations are obtained and after the CNS effects are produced. Rarely, lower doses of some agents can cause sudden cardiovascular collapse and death, probably due to sudden onset of ventricular fibrillation or action on pacemaker.

c. Smooth muscle: These drugs depress contractions in vascular, bronchial and gastrointestinal smooth muscles.

Hypersensitivity: Some people are hypersensitive to local anaesthetics and have allergic dermatitis or a typical asthma attack. The ester group of local anaesthetics is known to be more notorious in causing hypersensitivity; and also the addition of vasoconstrictor increases allergic reactions due to addition of sulfite as an antioxidant.

Metabolism of local anaesthetics:

The ester group is primarily hydrolyzed and inactivated by a plasma esterase, like plasma cholinesterase. The amide group is degraded in the liver by dealkylation and subsequent hydrolysis. The drug delivery to the liver is increased by factors like trauma, surgery, cancer, smoking, uremia and myocardial infarction etc. and decreased by oral contraceptive use, etc. As the toxicity depends on the balance

between rates of absorption and elimination, the rate of degradation of the drugs becomes very important in determining the clinical safety of these agents.

The commonly used local anaesthetics in otolaryngology clinic:

1. Lignocaine or Lidocaine:

This agent has intermediate to low potency, an onset of action of about 90 seconds and duration of action of 45-60 minutes. The topical preparations available are:

i. 1%, 2% and 4% solutions

ii. 2% viscous oral gel

iii. 2% aqueous based gel

iv. 4% and 10% spray

The maximum dose allowed without causing systemic toxicity is 3-5 mg/kg and topical preparations for office-based otolaryngology clinics rarely exceed the toxic dose and cause adverse reactions(72,73). To prevent potential lignocaine toxicity, the pharmacology and safety profile of the drug cannot be overlooked.

The half-life of the drug is 90 minutes irrespective of the mode of administration. Systemic reactions involve the cardiovascular (CVS) and the central nervous system (CNS), with the CNS being more susceptible. Lightheadedness and dizziness, followed by visual and auditory disturbances like difficulty in focusing on objects and tinnitus are the common manifestations. Signs of toxicity are due to the loss of inhibitory responses, and are usually manifested as tremors, shivering and muscular twitching. Untreated overdose can lead to generalized seizures, followed by coma and

death due to respiratory failure. The CVS manifestations include reduced contractility, conduction rate and excitability of cardiac muscles.

If an overdose/toxicity is detected the procedure should be discontinued, and pulse oximetry and hemodynamic monitoring should be initiated. Early supplementation of oxygen could prevent acidosis and hypoxia, and retard progression towards seizure and hemodynamic collapse(74). ICU support might be necessary in cases of severe toxicity.

Methemoglobinemia is a condition in which hemoglobin cannot bind to oxygen, because of its oxidation from ferrous state to the ferric state. It's a rare complication of the use of lignocaine and has been reported in bronchoscopy procedures, when lignocaine was combined with benzocaine(75). The symptoms include anxiety, headache, fatigue, coma and sometimes death. When the levels of methemoglobin is less than 30%, spontaneous recovery can be obtained in about 24 hours by removing the offending agent and administering oxygen. For severe cases, methylene blue at a dose of 1-2 mg/kg administered slowly intravenously is the treatment of choice.

Tetracaine:

It is a highly potent local anaesthetic, which has a slow onset of action of around 10 minutes, and duration of action between 60 to 120 minutes.

The half-life and systemic absorption of nasal tetracaine has not been clearly described, however, it is recommended to use less than 1ml of 2% tetracaine for office procedures. Significant tetracaine toxicity has rarely been described when used topically in the nose.

Sympathomimetics

Xylometazoline/ Oxymetazoline:

These are sympathomimetic drugs which act on alpha 1A-adrenoceptor agonists and cause vasoconstriction of cutaneous microvasculature. The onset of action is within seconds and the duration of action lasts for about 6 hours. The common side effects are burning, stinging, sneezing, dryness and sometimes headache. Rebound congestion is the undesired side effect which occurs due to prolonged use of the drug and leads to a condition called rhinitis medicamentosa.

TOPICAL AGENTS IN FLEXIBLE NPL SCOPY

There are no clear guidelines for the use of topical anaesthetic drugs for performing NPL scopy. Types of preparation which have been traditionally used include lidocaine, phenylephrine and lidocaine, oxymetazoline, xylometazoline and cocaine. Some of these were found to cause lessdiscomfort than others, some had side effects and some others were more expensive. Any method whichreduces discomfort will help in the examination, diagnosis and treatment of patients' disorders.

Studies have compared different preparations to placebo and to no treatment (1–5), but it remains unclear which is the best preparation to use, if any. There can also be a trade-off between using agents that may be beneficial to the patient in terms of reducing pain and discomfort but, for example gels and pastes, may obscure the image for the endoscopist(71).

Cain et al in their studied compared co-phenylcaine, saline and no spray, and found no significant difference in the pain/ discomfort, ease of examination and quality of view

between the groups(1). Georgalas et al compared the effect of co-phenylcaine and saline and found no significant difference between the two groups. They also reported a worse taste scores for the co-phenylcaine(4). Leder et al compared tetracaine, ephedrine and saline and found no difference in the outcome measure(5).

Frosh et al compared lidocaine, saline and no treatment and demonstrated a significantly higher pain scores in the lignocaine group(2). Sadek et al in 2001 compared lignocaine/ phenylephrine, xylometazoline, lignocaine and no treatment. This study did not demonstrate any difference in the pain scores but reported a reduced level of general unpleasantness when using vasoconstrictor(76).

The study by Lennox et al and Smith et al compared co-phenylcaine and cocaine and did not find any difference in the pain scores(77,78). As these studies did not make a comparison against placebo or no treatment, a conclusion on the benefit of topical agents cannot be drawn.

These studies however had low sample size (~100). Furthermore, there have been no studies that compare all the modes of application and the agents used.

MATERIALS AND METHODS

Study design:

A randomized control open label study

Study population:

Patients who attended the ENT out-patient department and for whom a flexible nasopharyngolaryngoscopy was ordered for evaluation of their ENT complaints.

Inclusion criteria:

1. Patients requiring a transnasal flexible nasopharyngolaryngoscopy
2. Age > 18 years
3. Patients who could complete the post-procedure questionnaire following the examination

Exclusion criteria:

1. Any known bleeding disorders
2. Pregnancy
3. Known allergy to any of the drugs to be used

4. History of a previous nasopharyngolaryngoscopy- to reduce bias on objective assessment.

Pilot study:

A pilot study was done to assess the feasibility of the study and to calculate sample size. In the pilot, 10 patients were included in each arm. The results of the pilot study are summarized in the table below.

Agent	Mean
Lignocaine spray	2.6
Lignocaine gel	2.9
Pledget	2.5
Aqueous gel	3.0

Study period:

This was a prospective study conducted between August,2016 to August,2017

Ethics Committee Approval:

Once the study proposal was made, it was put forward to the Institutional Research Board. After obtaining the approval from the ethics committee (IRB Min No. 9801), the study was initiated in August,2016.

Statistics:

Sample size calculation:

Using pilot study data with a maximum difference of 1 in mean pain score between any 2 groups with a standard deviation of 2.1, 80% power and 5% α ; the sample size was calculated as 95 in each group.

Study recruitment:

Patients who had to undergo a nasopharyngolaryngoscopy were included in the study based on the inclusion and exclusion criteria mentioned above. The patients who met the inclusion criteria were randomly allocated to one of the four groups:

i. 10% lignocaine spray

ii. 2% lignocaine gel

iii. 4% lignocaine solution with 0.05% xylometazoline (1:1) pledgets

iv. Water based aqueous gel

The endoscopy room nurse prepared the patient according to the allotted envelope -2 sprays of 10% lignocaine in both nostrils or 1 pledget of lignocaine + xylometazoline

in each nostril. In the gel group, 1-2 ml of the gel was applied on the scope prior to scopy.

Then, the endoscopy was performed and at the end of examination, the patient and the examiner were given separate questionnaires to fill up. (Appendix page iv and v)

The methodology algorithm was as follows:

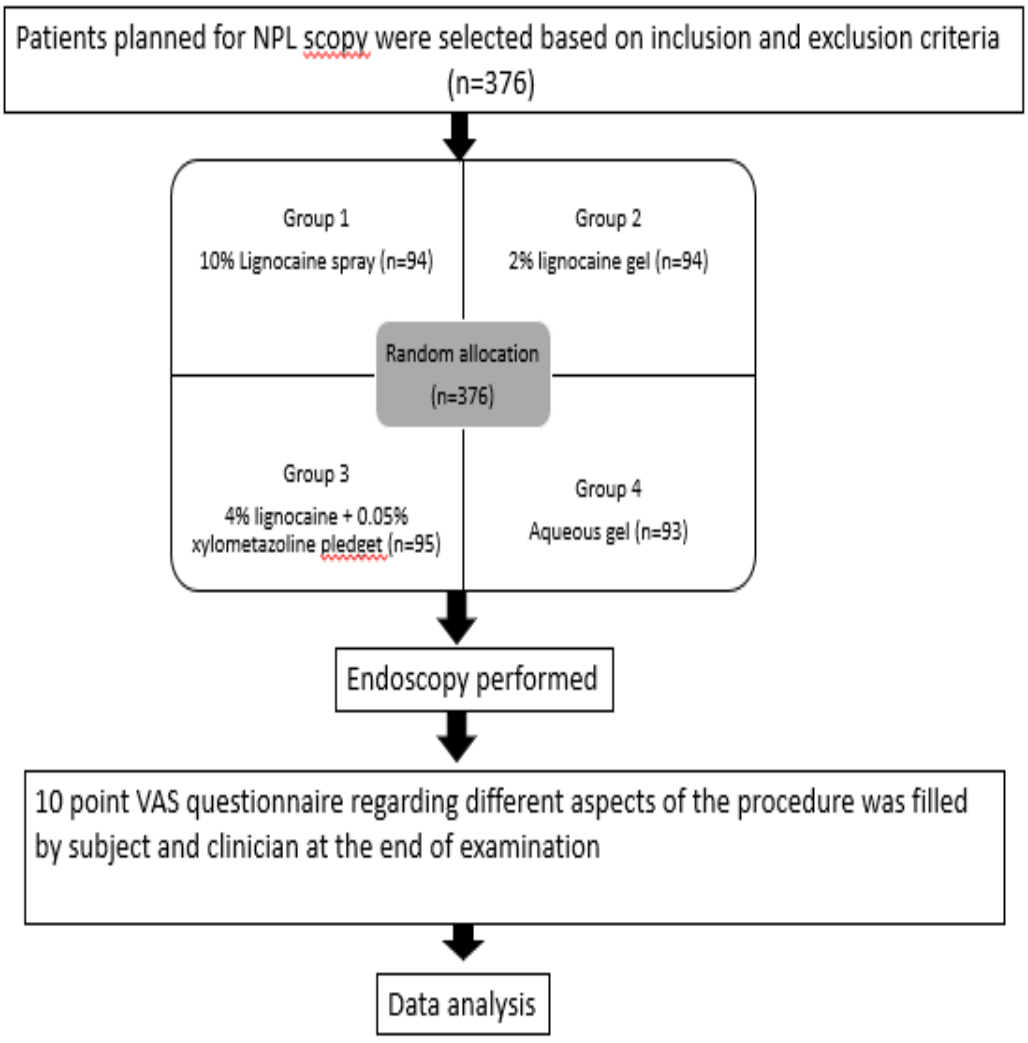


Fig 47: Methodology flow diagram

Statistical analysis:

Categorical variables were summarized using counts and percentages. Quantitative variables were summarized using mean (SD) for normally distributed variables and median (IQR) for skewed variables. Chi square test was used to compare the proportions between categorical variables. One way analysis of variance was used to compare the mean between more than two groups for the normally distributed variables and for skewed variables Kruskalwallis H test was used. The Independent t-test was used to compare the means between two groups for normally distributed continuous variables and the Mann-Whitney U test was used for skewed variables. Pearson's correlation coefficient test was used to find the relationship between normally distributed continuous variables and Spearman's rank correlation was used for the skewed variables. For all the analysis, 5% level of significance was considered to be significant. All the statistical analysis was done using stata/ic v.13.1.

RESULTS

This prospective randomised open label study was conducted in the department of ENT in Christian Medical college, Vellore. Patients who had to undergo a flexible nasopharyngolaryngoscopy for the first time were eligible to participate in the study and were randomly allotted into the four study groups, if they fulfilled the inclusion criteria. A total of 376 patients were recruited into the study from the period between August,2016 to August,2017. The baseline characteristics of the study population and the statistical analysis are described below.

BASELINE CHARACTERISTICS OF STUDY POPULATION

Randomization

The patients recruited into the study were randomly allocated into four study groups. The numbers in each group were:

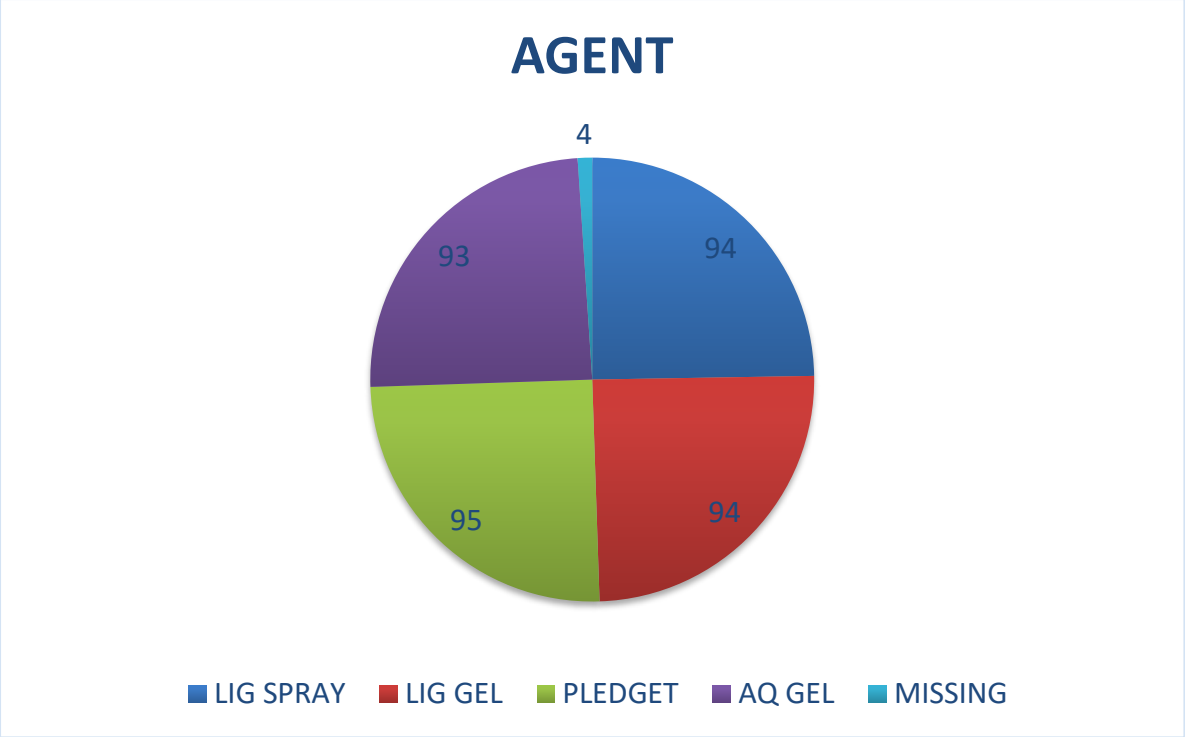


Fig 48: Randomization into various groups

The 4 missing were due to loss of randomization envelopes.

Age

The mean age (± SD) of the patients was 42.8(13.6). The youngest patient was 18 years and oldest patient was 80 years. The age distribution of the population was as follows:

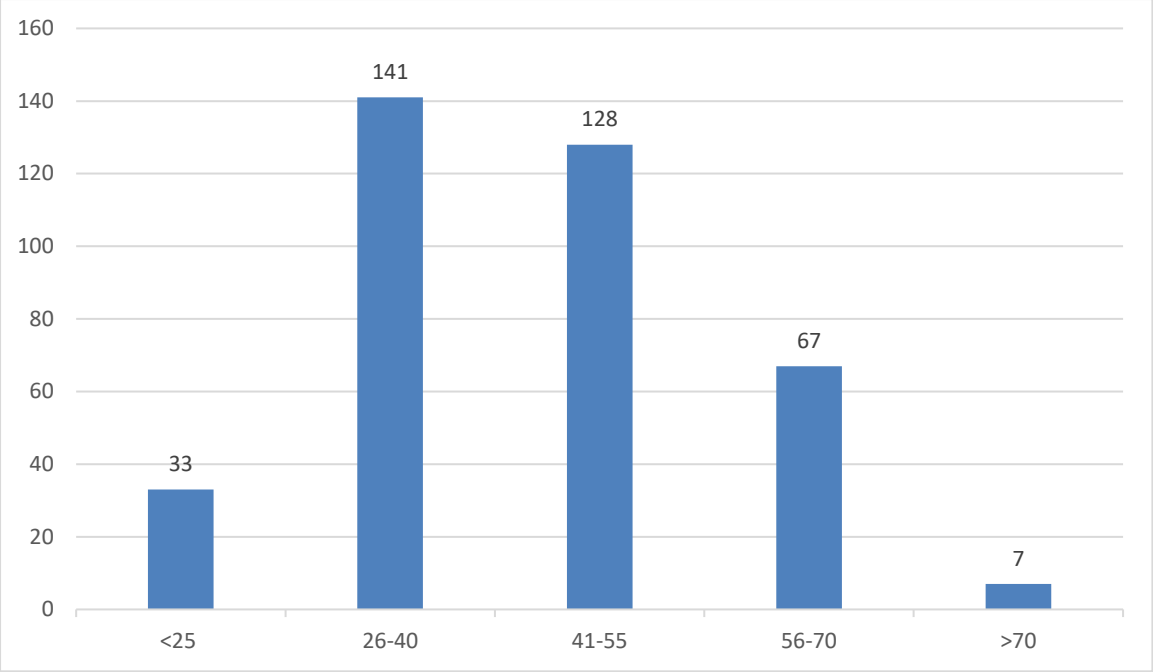


Fig 49: Age distribution of study population

Sex distribution:

Among the total of 376 patients who were recruited, 211 were males and 165 were females.

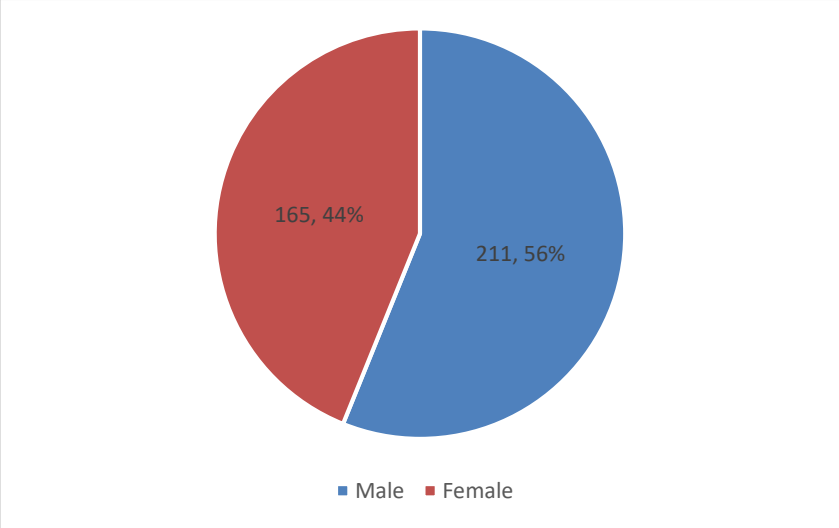


Fig 50: Sex distribution of study population

The sex distribution in all the different groups of intervention was as follows:

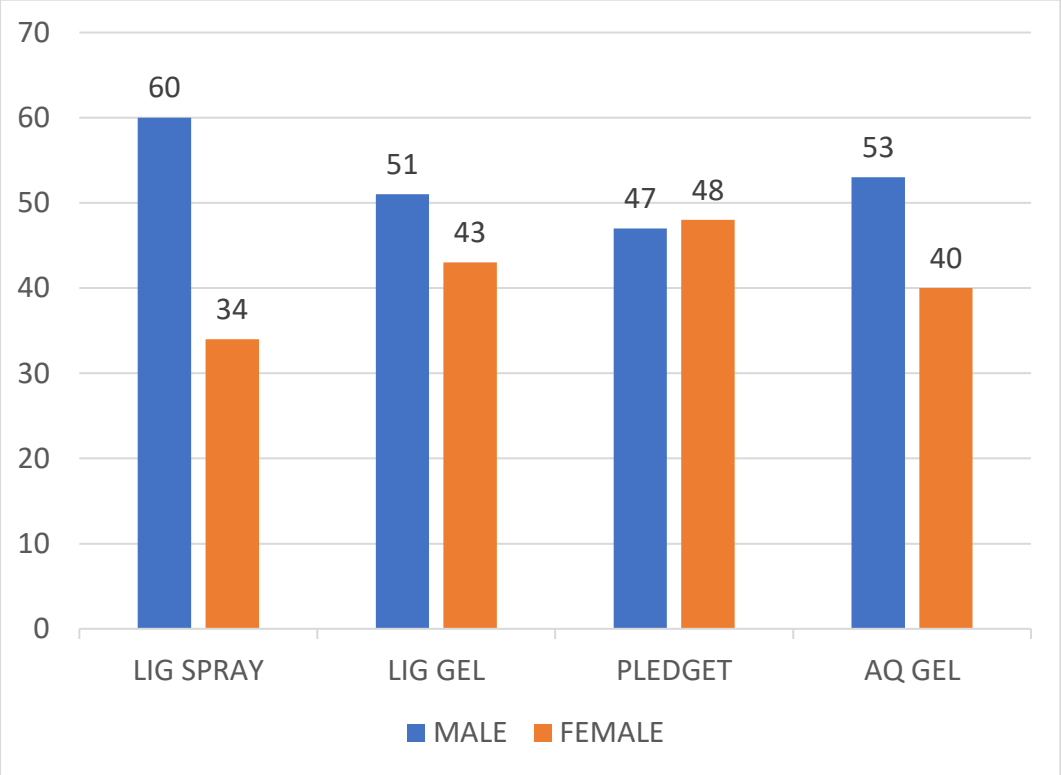


Fig 51: Sex distribution in the various study groups

STATISCAL DATA ANALYSIS

After the endoscopy was performed, all patients were given a questionnaire and asked to grade the symptoms on a 10 point visual analogue scale where 1 was when the least symptoms were experienced and 10 the most symptoms were experienced.

1. **Overall pain/ discomfort**

   The mean(±SD) for the overall pain/discomfort was 2.98(1.06) in the lignocaine spray group, 2.89(1.45) in lignocaine gel group, 2.8(0.91) in the otrivin-lignocaine pledget group and 3.03(1.17) in the aqueous gel group. The p value was 0.527; thus, there was no statistically significant difference between the groups.

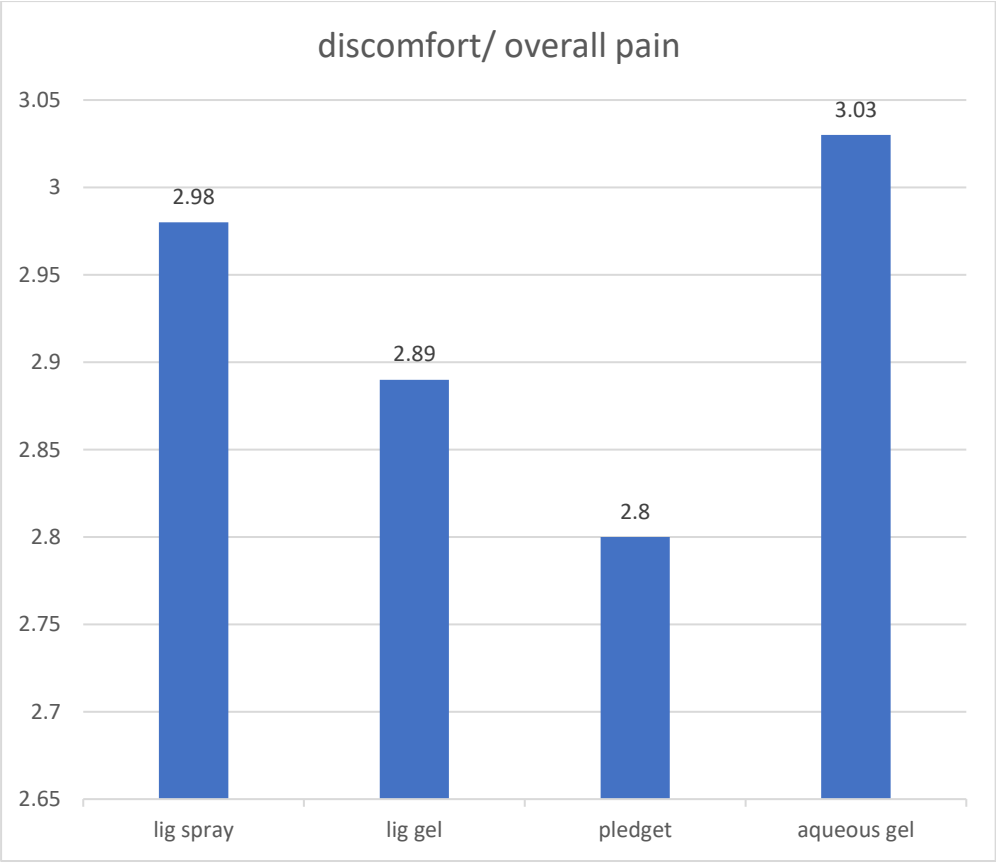


Fig 52: Overall pain/Discomfort in the various

2. Gender vs overall pain/discomfort

There was found to be no significant difference in the overall pain/discomfort scores in males and females (p=0.8481).

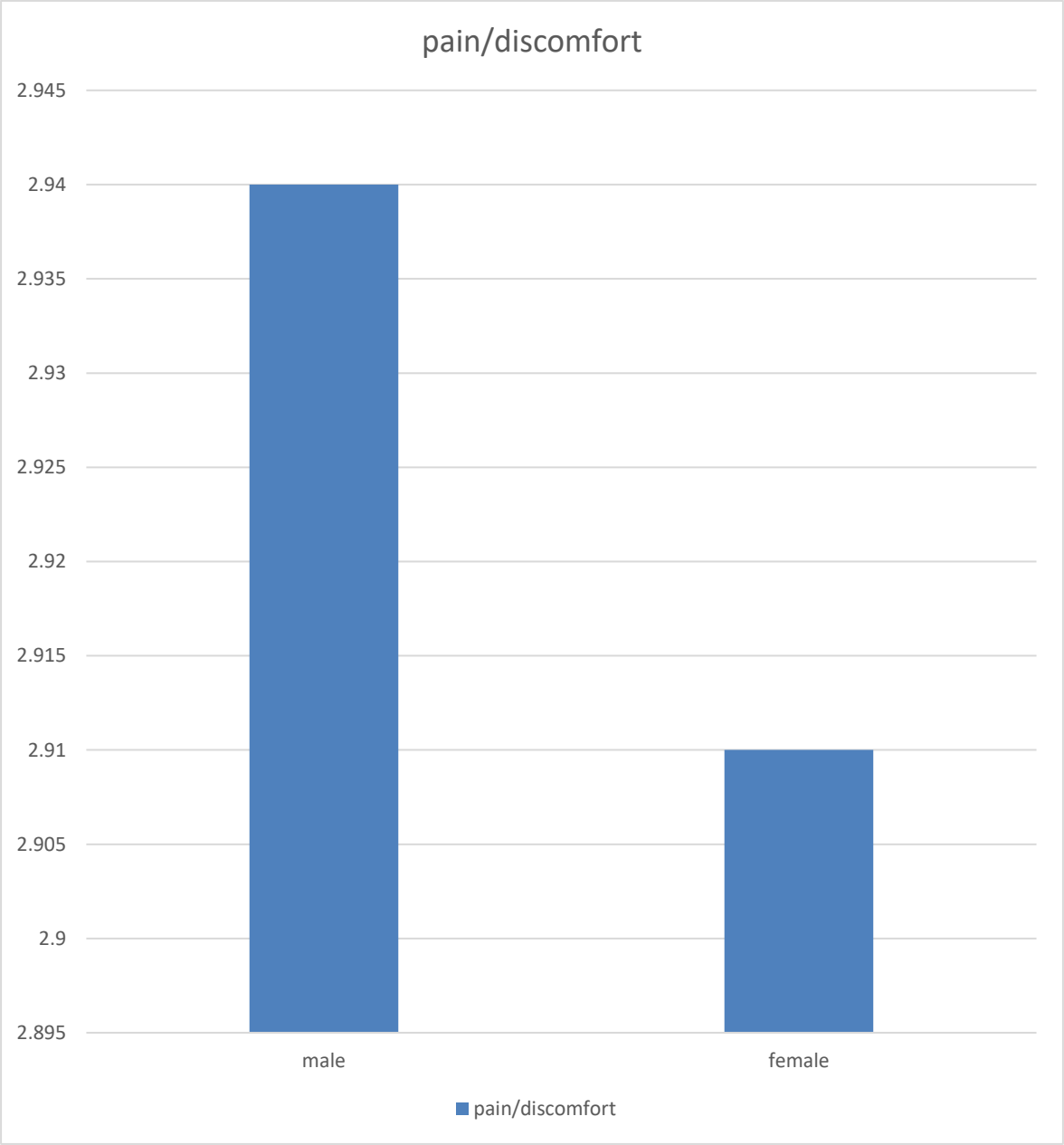


Fig 53: Gender vs Overall pain/Discomfort

3. **Burning/ stinging after application of agent**

As the data was not normally distributed, the median and interquartile range (25^{th} to 75^{th} percentile) for each of the groups is mentioned in the table below. The p value was 0.0001, thus saying that the burning is significantly higher in the lignocaine spray group when compared to the other groups.

	MEDIAN	IQR(0.25,0.75)
LIG SPRAY	2.00	1.00, 2.00
LIG GEL	1.00	1.00, 1.00
PLEDGET	1.00	1.00,2.00
AQ GEL	1.00	1.00, 1.00

Table 1: Stinging/Burning in the various groups

4. **Nose pain**

As the data was not normally distributed, the median and interquartile range (25^{th} to 75^{th} percentile) for each of the groups is mentioned in the table below. The p value was 0.4875; hence, there was no statistically significant difference in the scores between the 4 groups.

	MEDIAN	IQR(0.25,0.75)
LIG SPRAY	1.00	1.00, 2.00
LIG GEL	1.00	1.00, 2.00
PLEDGET	1.00	1.00,2.00
AQ GEL	1.00	1.00, 2.00

Table 2: Nose pain in the various groups

5. **Throat pain**

As the data was not normally distributed, the median and interquartile range (25^{th} to 75^{th} percentile) for each of the groups is mentioned in the table below. The p value was 0.7839; hence, there was no statistically significant difference in the scores between the 4 groups.

	MEDIAN	IQR(0.25,0.75)
LIG SPRAY	1.00	1.00, 1.00
LIG GEL	1.00	1.00, 1.00
PLEDGET	1.00	1.00,1.00
AQ GEL	1.00	1.00, 1.00

Table 3: Throat pain in the various groups

6. **Gagging/ nausea sensation**

As the data was not normally distributed, the median and interquartile range (25^{th} to 75^{th} percentile) for each of the groups is mentioned in the table below. The p value was 0.3185; hence, there was no statistically significant difference in the scores between the 4 groups.

	MEDIAN	IQR(0.25,0.75)
LIG SPRAY	1.00	1.00, 2.00
LIG GEL	1.00	1.00, 1.00
PLEDGET	1.00	1.00,1.00
AQ GEL	1.00	1.00, 1.00

Table 4: Gagging scores in the various groups

7. **Unpleasant taste**

As the data was not normally distributed, the median and interquartile range (25^{th} to 75^{th} percentile) for each of the groups is mentioned in the table below. The p value was 0.0928; hence, there was no statistically significant difference in the scores between the 4 groups.

	MEDIAN	IQR(0.25,0.75)
LIG SPRAY	1.00	1.00, 1.00
LIG GEL	1.00	1.00, 1.00
PLEDGET	1.00	1.00,1.00
AQ GEL	1.00	1.00, 1.00

Table 5: Unpleasant taste scores in the various groups

8. **Foreign body sensation in throat**

As the data was not normally distributed, the median and interquartile range (25^{th} to 75^{th} percentile) for each of the groups is mentioned in the table below. The p value was 0.190; hence, there was no statistically significant difference in the scores between the 4 groups.

	MEDIAN	IQR(0.25,0.75)
LIG SPRAY	1.00	1.00, 1.00
LIG GEL	1.00	1.00, 1.00
PLEDGET	1.00	1.00,1.00
AQ GEL	1.00	1.00, 1.00

Table 6: Foreign body sensation scores in the various groups

9. **Trouble swallowing**

As the data was not normally distributed, the median and interquartile range (25^{th} to 75^{th} percentile) for each of the groups is mentioned in the table below. The p value was 0.273; hence, there was no statistically significant difference in the scores between the 4 groups.

	MEDIAN	IQR(0.25,0.75)
LIG SPRAY	1.00	1.00, 1.00
LIG GEL	1.00	1.00, 1.00
PLEDGET	1.00	1.00,1.00
AQ GEL	1.00	1.00, 1.00

Table 7: Swallowing trouble scores in the various groups

10. Breathing difficulty

The mean (±SD) score was 1.02(0.14) in the lignocaine spray group, 1(0.15) in the lignocaine gel group, 1.01(0.10) in the pledget group and 1.02(0.21) in the aqueous gel group. The p value was 0.7443 suggesting no statistical difference between the groups

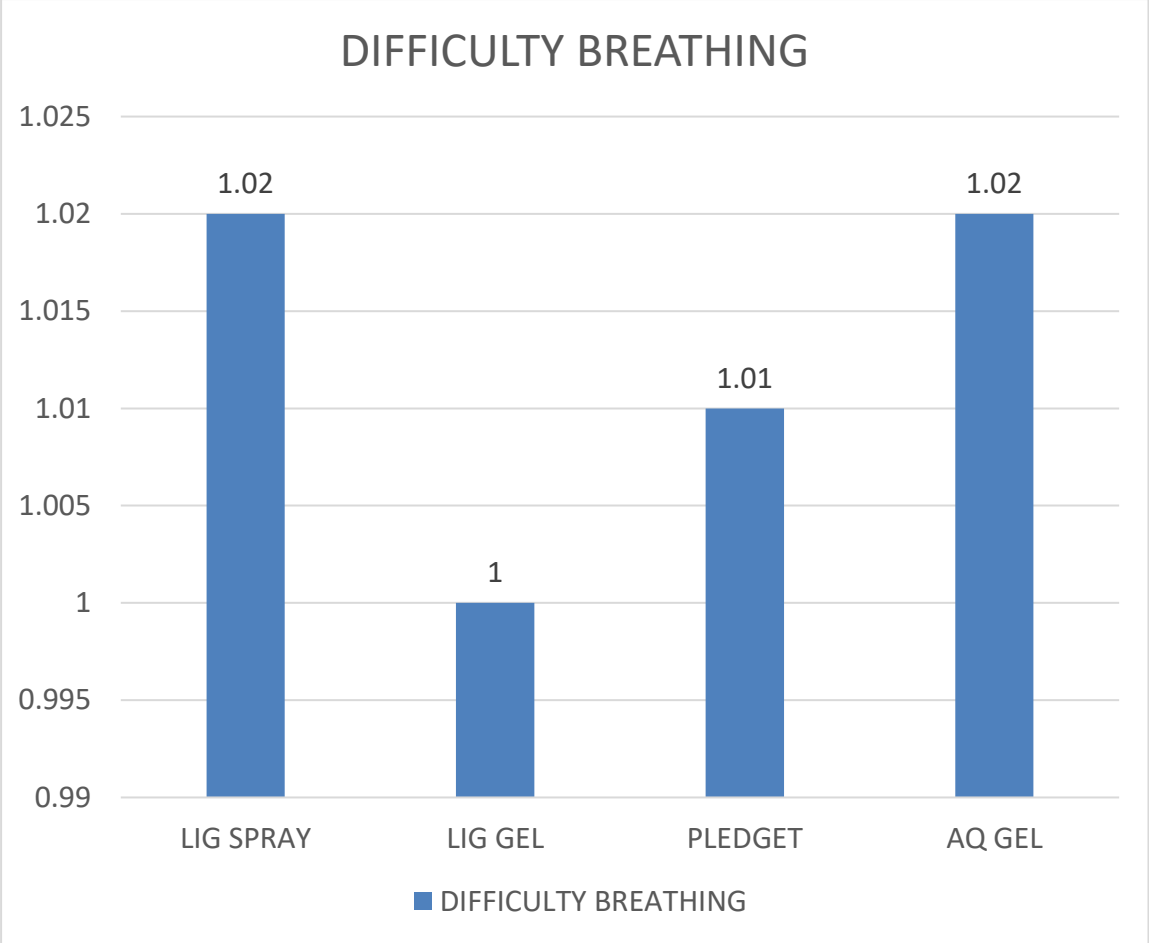


Fig 54: Breathing difficulty scores in the various groups

11. Willingness to undergo the procedure again if needed

The mean (±SD) score was 7.65(1.64) in the lignocaine spray group, 7.77(1.61) in the lignocaine gel group, 7.75(1.46) in the pledget group and 7.61(1.45) in the aqueous gel group. The p value was 0.8834 suggesting no statistical difference between the groups.

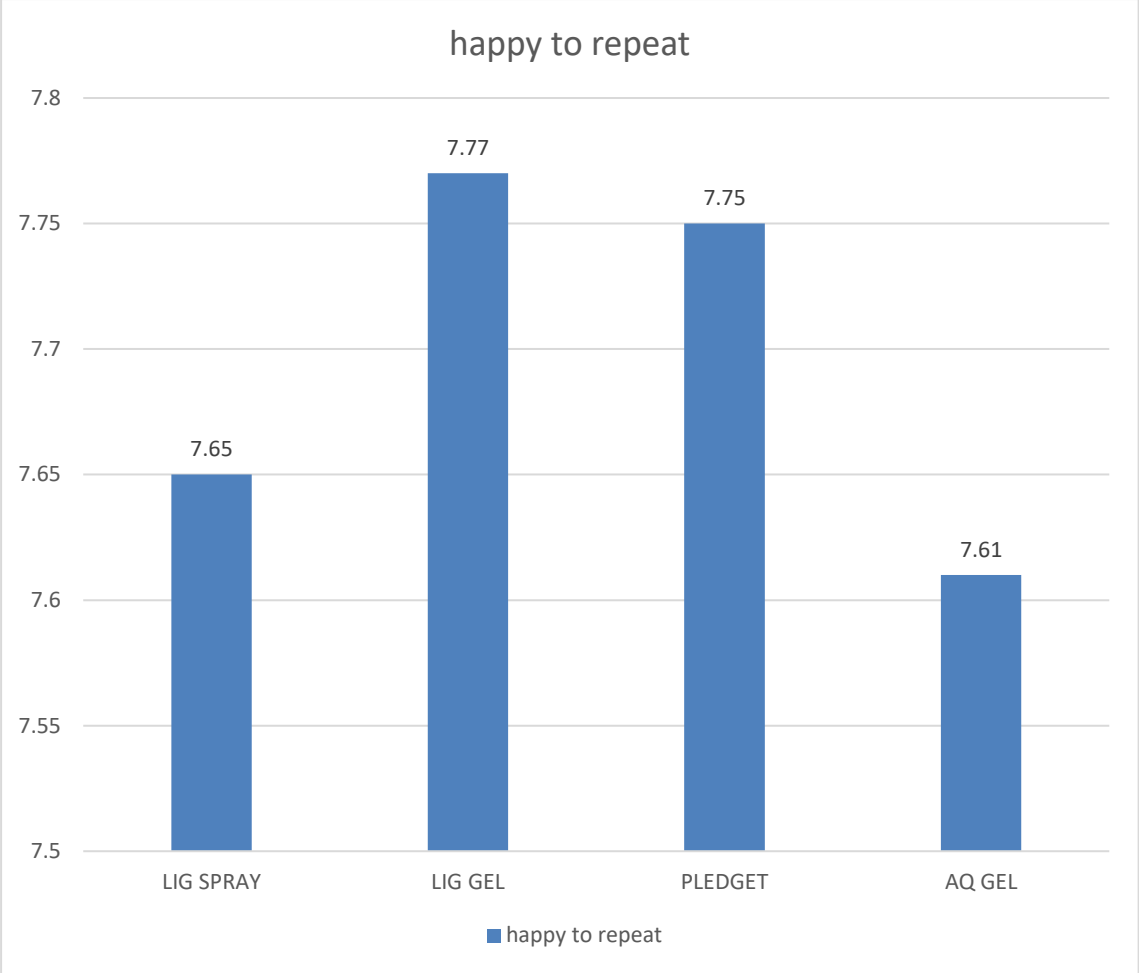


Fig 55: Willingness to repeat test scores in the various groups

12. Anxiety vs discomfort

The patients were asked to grade their level of anxiety at the beginning of the test on a scale from 1-10. These values were analysed against the overall pain/discomfort scores. There was found to be a positive correlation of 0.258 with a p value <0.001

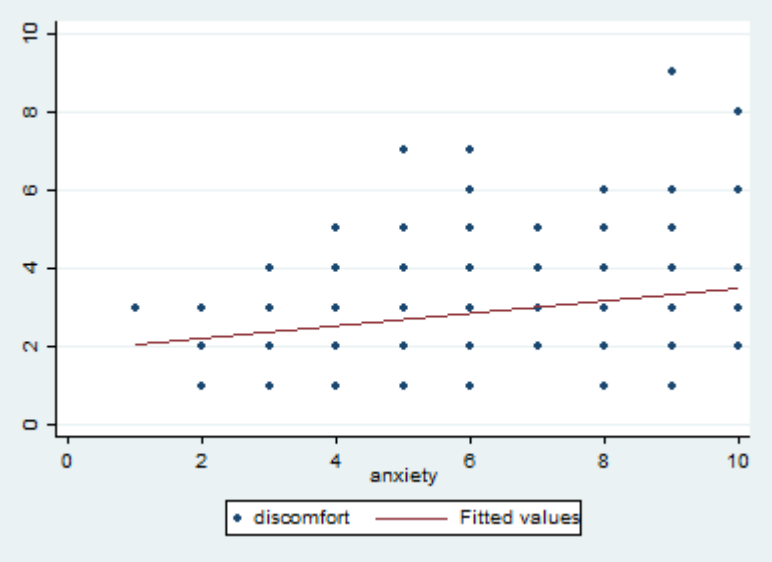


Fig 56: Anxiety vs discomfort

The clinician performing the endoscopy was given a questionnaire at the end of the procedure and the various aspects of scopy were graded on a scale from 1-10.

1. **Ease of doing scopy**

   The mean (±SD) score was 8.20(1.51) in the lignocaine spray group, 8.50(1.49) in the lignocaine gel group, 8.45(1.39) in the pledget group and 8.50(1.32) in the aqueous gel group. The p value was 0.4177 suggesting no statistical difference between the groups.

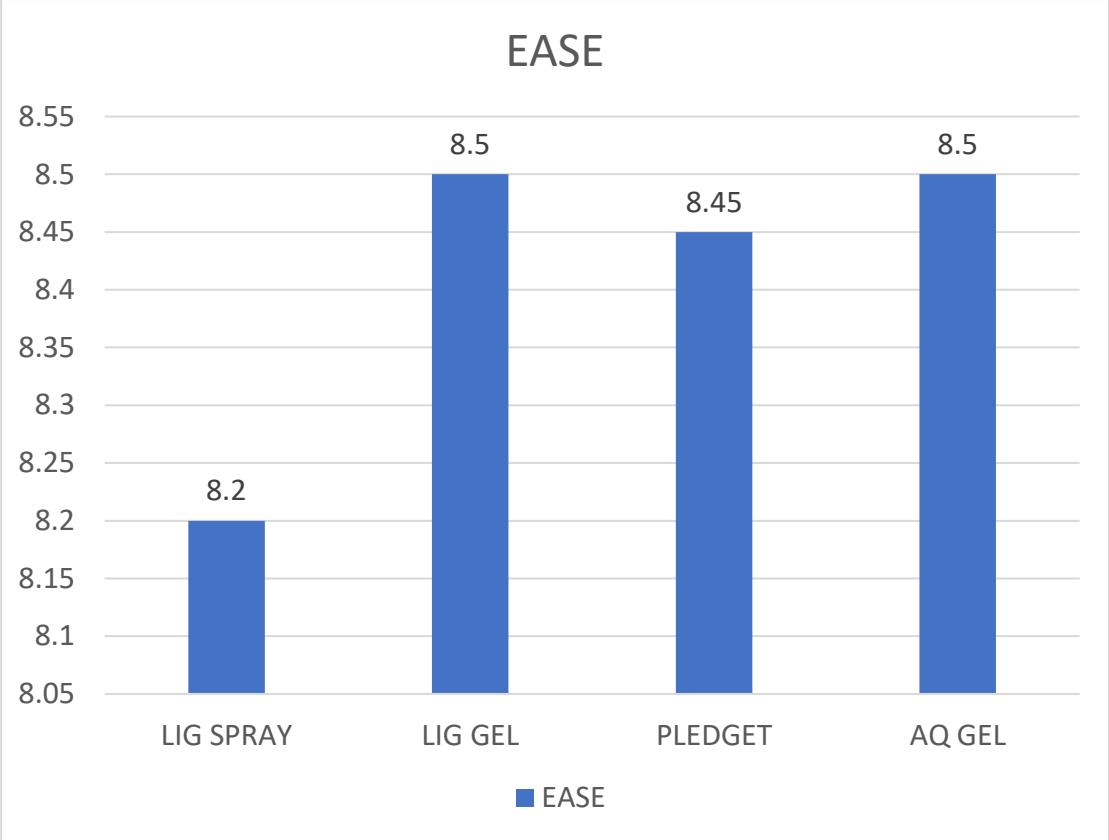


Fig 57: Ease of performing scopy in the various groups

2. Quality of view

The mean (±SD) score was 8.38(1.31) in the lignocaine spray group, 8.70(1.28) in the lignocaine gel group, 8.73(1.10) in the pledget group and 8.66(1.18) in the aqueous gel group. The p value was 0.1938 suggesting no statistical difference between the groups.

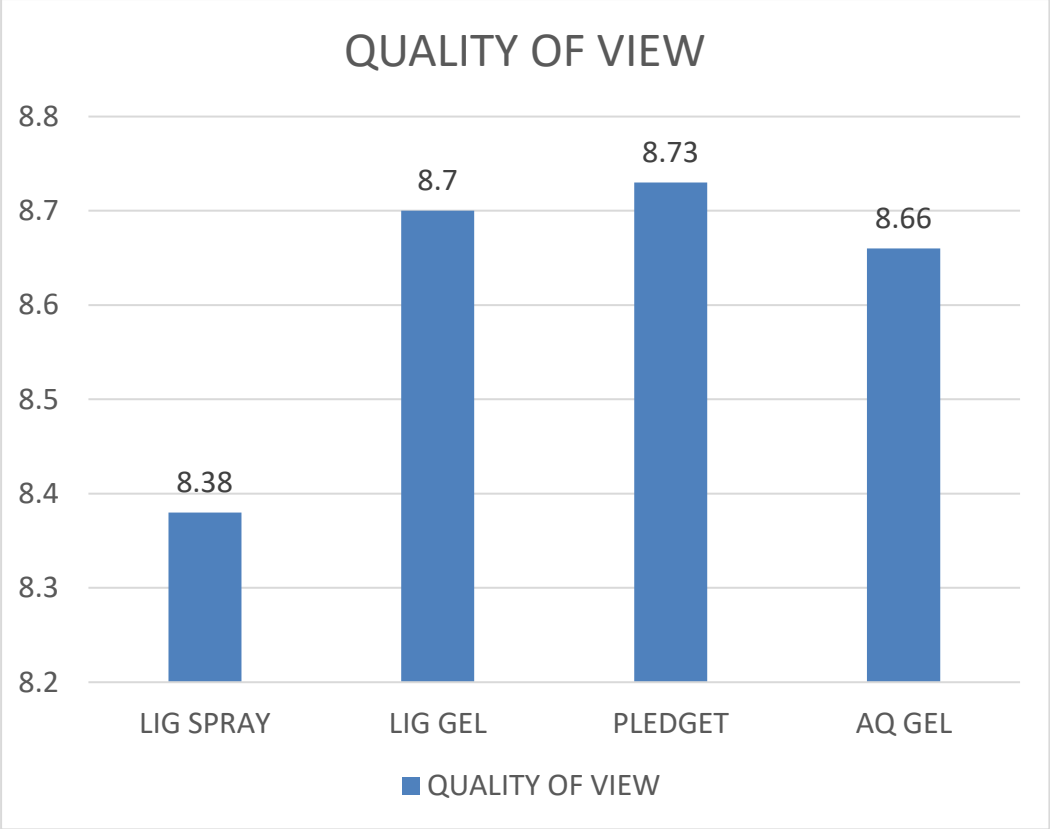


Fig 58: Quality of view in the various groups

3. Adequacy of examination

There were 2 procedures which were incomplete- 1 in the lignocaine gel group and 1 in aqueous gel group due to excessive gagging by the patient.

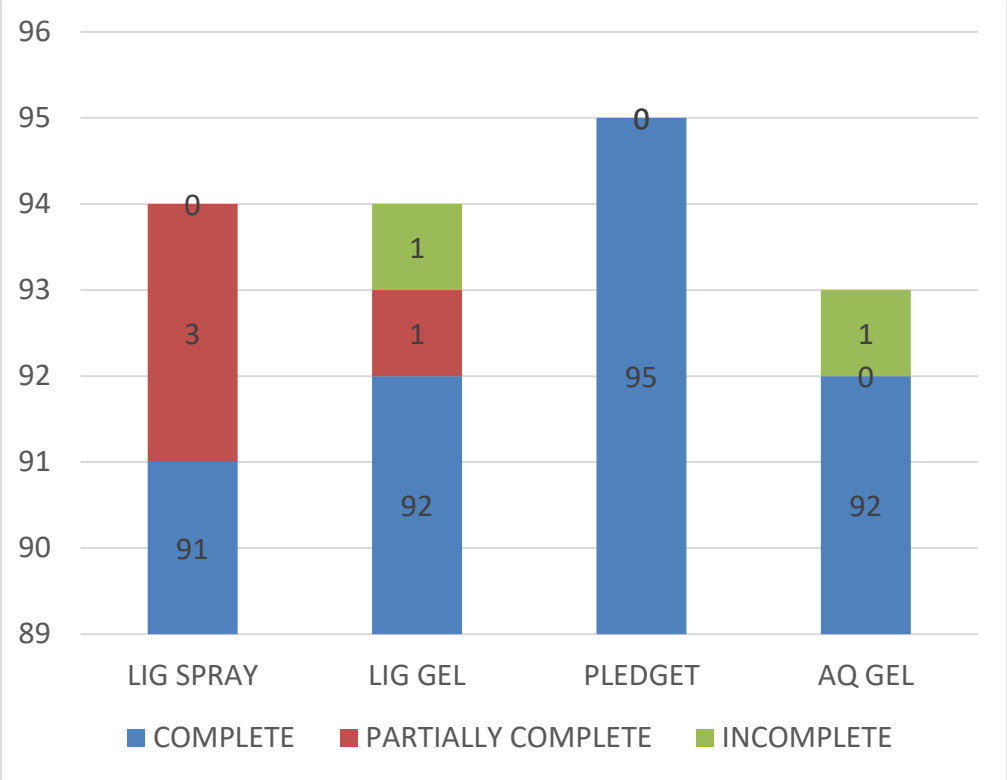


Fig 59: Adequacy of examination across the various groups

4. Experience of the doctor

The overall pain/discomfort was analysed against the doctor's experience in doing scopies. As the data was not normally distributed, the median and interquartile range (25^{th} to 75^{th} percentile) for each of the groups is mentioned in the table below. The p value is 0.9868 which suggests no statistically significant difference between the groups.

EXPERIENCE	MEDIAN	IQR(0.25,0.75)
<3 MONTHS	3.00	2.00, 3.00
3-6 MONTHS	3.00	2.00, 3.00
6-12 MONTHS	3.00	2.00,4.00
>12 MONTHS	2.00	2.00, 3.00

Table 8: Experience vs discomfort

5. **Provisional diagnosis/ Indication of doing scopy**

The overall pain/discomfort was analysed against the provisional diagnosis of the patient/ Indication of scopy. As the data was not normally distributed, the median and interquartile range (25^{th} to 75^{th} percentile) for each of the groups is mentioned in the table below. The p value is 0.0739 which suggests no statistically significant difference between the groups.

DIAGNOSIS	MEDIAN	IQR(0.25,0.75)
BENIGN	3.00	2.00, 3.00
MALIGNANT/ PROBABLY MALIGNANT	3.00	2.50, 4.00
OSA	3.00	2.00,4.00
SWALLOWING ASSESSMENT	2.00	3.00, 3.00

Table 9: Diagnosis vs discomfort

6. **Ease of doing scopy vs discomfort.**

The scores for ease of performing the scopy were analysed against the overall pain/discomfort scores. There was found to be a negative correlation of 0.3059 with a p value= 0.000

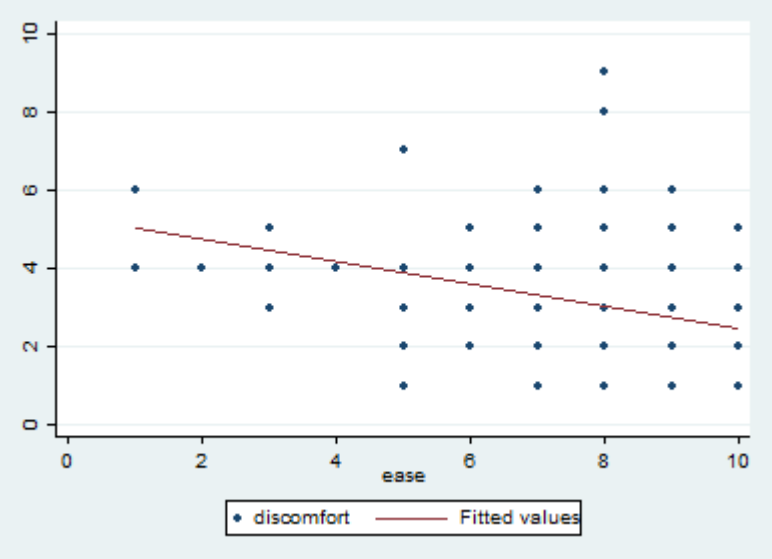


Fig 60: Ease of performing scopy vs discomfort

7. **Quality of view vs discomfort**

The scores for ease of performing the scopy were analysed against the overall pain/discomfort scores. There was found to be a negative correlation of 0.2594 with a p value= 0.000

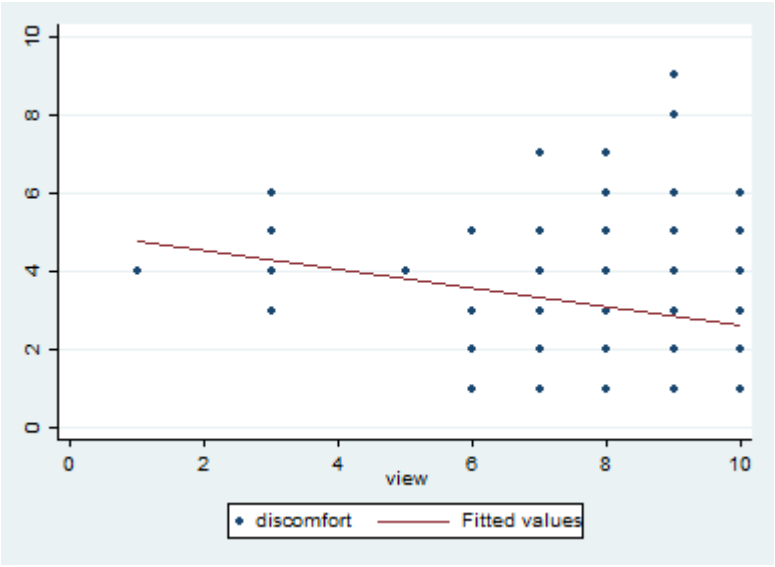


Fig 61: Quality of view vs discomfort

DISCUSSION

Flexible nasopharyngolaryngoscopy (NPL scopy) is a procedure routinely done in ENT clinics nowadays as it provides an unparalleled view of the laryngopharyngeal structures. It involves the use of a flexible fiberoptic scope for diagnostic purposes, as well as novel therapeutic procedures. The procedure may cause discomfort to the patient, making accurate assessment difficult at times. A wide range of topical agents are available to reduce pain or discomfort experienced during this procedure. These include topical preparations of cocaine, lignocaine (2%, 4%, 5% or 10%), oxymetazoline, xylometazoline or a combination of lignocaine with either phenylephrine, oxymetazoline or xylometazoline. These agents can be administered in the form of sprays, gels, pastes, creams or pledgets soaked with the solution.

In one of the earlier studies by Frosh et al on comparison of agents used in NPL scopy in alleviating pain, he studied 3 groups (lidocaine spray, saline spray and no treatment) and concluded that individuals receiving lignocaine had higher pain scores (2). In our study, where we compared lignocaine and aqueous gel; the pain scores were not significantly different between the study arms.

Comparing the use of cophenylcaine, saline and no spray, Cain et al found no significant difference in the pain/ discomfort, ease of examination and quality of view between the groups. He remarked that the routine use of topical nasal preparation could be discontinued(1). However the study was biased as lubricating gel was applied prior to introduction of scope. To counter this we had a separate arm where

lubricating gel was solely used. Georgalas et al compared the effect of cophenylcaine and saline and found no significant difference between the two groups. They also reported a worse taste scores for the cophenylcaine(4). Leder et al compared tetracaine, ephedrine and saline and found no difference in the outcome measure(5).

Sadek et al in 2001 compared lignocaine with phenylephrine, xylometazoline, lignocaine and no treatment. His study did not demonstrate any difference in the pain scores but reported a reduced level of general unpleasantness when vasoconstrictors were used(76). Our study failed to demonstrate similar results with vasoconstrictor use.

In studies by Lennox et al and Smith et al where they compared cophenylcaine and cocaine, they found no difference in the pain scores(77,78). As these studies did not make a comparison against placebo or no treatment, a conclusion on the benefit of topical agents cannot be drawn.

The major drawback was that these studies had a low sample size (~100). Furthermore, there have been no studies that compare all the modes of application and the agents used.

This study was conducted to compare the various available preparations of lignocaine using different methods of application (spray, pledget and gel) and to assess whether an anaesthetic is needed at all for alleviating patient discomfort.

Our study population included 376 subjects whose mean age was 43 years. Of the 376 patients enrolled, there were 211 males and 165 females.

Our study did not show any significant statistical difference in the mean pain scores between the four groups which was in keeping with most of the studies done before(1,4,5,76). The sample size in most of these studies was small (sample size ~ 100); with about 25-50 participants in the each of the various arms. So it may be difficult to gauge the significance of the pain scores obtained in these studies. A point to be noted is the low mean VAS scores for overall pain/discomfort from the procedure across all groups. This suggests that despite the clinician's concerns about subjecting the patient to a very uncomfortable out-patient procedure, most patients do not find flexible NPL scopy uncomfortable, irrespective of whether an anaesthetic/ vasoconstrictor is used or not.

The secondary outcome measures related to the patient which were evaluated in our study were:

- Burning/stinging in the nose after application of agent
- Nasal pain
- Throat pain
- Gag/nausea
- Unpleasant taste
- Foreign body sensation in throat
- Swallowing difficulty
- Breathing difficulty
- Readiness to repeat the test if required

In our study, a significantly higher degree of burning sensation was noted after application of 10% lignocaine spray (p=0.0001) when compared to the other

agents. A similar result was seen in the studies by Sadek et al and Georgalas et al where a higher level of unpleasantness was seen when using anaesthetic/ vasoconstrictor preparation(4,76).

The other secondary outcome measures showed no significant statistical difference as was seen in the other studies. Majority of the patients were willing to undergo the examination again if needed (mean ± SD= 7.69 ± 1.54).

A positive correlation between anxiety and discomfort scores was seen as pointed out in the study by Cain et al(1); those who were more anxious had higher discomfort ($p<0.001$).

Lubrication of the endoscope with topical agents in the gel or paste form helps in the introduction and advancement of the scope. Pothier et al in their study described a sub optimal view when using gels/pastes(71). In our study though there were two groups in which the agents were used in the gel form, no significant difference in the quality of the view was noted when compared to sprays or pledgets.

The study by Cain et al showed negative correlation between the ease of doing endoscopy and the pain scores and between quality of view and pain score. Similar results were seen in our study.

Most of the procedures were complete and there was no significant statistical difference between the groups.

Comparing the overall pain/discomfort with the examiner's experience, we found no significant statistical difference. It would be expected that, when more

experienced examiners do the scopy, the discomfort score would be lower; however, no such correlation was seen.

The patient's diagnoses did not have any bearing on the primary outcome measure. More discomfort would be expected in those with malignant conditions as more detailed and thorough examinations are needed. This observation probably suggests that the skill and competency in performing NPL scopy can be easily learnt.

There were no reported complications. A few patients gagged excessively.

The introduction of flexible fibreoptic technique has revolutionised the field of Otorhinolaryngology. Flexible fiberoptic nasopharyngolaryngoscopy is well tolerated by the patients and expertise required to perform the scopy can be easily acquired. Aqueous gel is not inferior to Lignocaine, be it used in the form of sprays, gels or pledgets. The addition of a vasoconstrictor did not have a effect on the patient tolerance of the procedure.

The procedure acceptance and completion depends greatly on the patient's attitude towards the procedure; other factors have shown to have little effect on the primary outcome.

LIMITATIONS

1. There is a certain degree of bias in this study as blinding was not possible due to the use of different methods of drug application.
2. A single examiner would have provided better standardization of the procedure; but for practical reasons multiple examiners performed the scopies thus reducing bias.
3. Most of the scopies were performed by residents and thus comparing the primary outcome with experience might not represent the actual results.
4. The visual analogue scale being a subjective scale would lead to some amount of bias.

CONCLUSION

In this study it was found that there was no significant difference in the overall pain/discomfort among the four groups. Moreover, the low mean scores across all groups suggest that the procedure is well tolerated by majority of the population. The anaesthetic preparation -10%lignocaine spray causes a burning sensation in the nose resulting in more discomfort. The gel formulations used in this study were not found to affect the ease of performing scopy or the quality of view. Aqueous gel could be used as a topical agent in the patients undergoing a flexible nasopharyngolaryngoscopy instead of an anaesthetic agent alone or in combination with a nasal decongestant This would lead to a potential savings in terms of time and money.

BIBLIOGRAPHY

1. Cain AJ, Murray DP, McClymont LG. The use of topical nasal anaesthesia before flexible nasendoscopy: a double-blind, randomized controlled trial comparing cophenylcaine with placebo. Clin Otolaryngol Allied Sci. 2002 Dec;27(6):485–8.

2. Frosh AC, Jayaraj S, Porter G, Almeyda J. Is local anaesthesia actually beneficial in flexible fibreoptic nasendoscopy? Clin Otolaryngol Allied Sci. 1998 Jun;23(3):259–62.

3. Singh V, Brockbank MJ, Todd GB. Flexible transnasal endoscopy: is local anaesthetic necessary? J Laryngol Otol. 1997 Jul;111(7):616–8.

4. Georgalas C, Sandhu G, Frosh A, Xenellis J. Cophenylcaine spray vs. placebo in flexible nasendoscopy: a prospective double-blind randomised controlled trial. Int J Clin Pract. 2005 Feb;59(2):130–3.

5. Leder SB, Ross DA, Briskin KB, Sasaki CT. A prospective, double-blind, randomized study on the use of a topical anesthetic, vasoconstrictor, and placebo during transnasal flexible fiberoptic endoscopy. J Speech Lang Hear Res JSLHR. 1997 Dec;40(6):1352–7.

6. Clary MS, Courey MS. Development of procedures and techniques for the office. Otolaryngol Clin North Am. 2013 Feb;46(1):1–11.

7. Assimakopoulos D, Patrikakos G, Lascaratos J. Highlights in the evolution of diagnosis and treatment of laryngeal cancer. The Laryngoscope. 2003 Mar;113(3):557–62.

8. Alberti PW. The history of laryngology: a centennial celebration. Otolaryngol--Head Neck Surg Off J Am Acad Otolaryngol-Head Neck Surg. 1996 Mar;114(3):345–54.

9. Reuter HJ, Reuter MA. Philipp Bozzini and endoscopy in the 19th Century. Max Nitze Museum; 1988.

10. (M.D.) KK, Kendall KA, Leonard R. Laryngeal Evaluation: Indirect Laryngoscopy to High-speed Digital Imaging. Thieme; 2010. 306 p.

11. Desormeaux AJ. The endoscope, and its application to the diagnosis and treatment of urinary affections [trans. by RP Hunt]. Chic Med J. 1867;24:184.

12. Scalco AN, Shipman WF, Tabb HG. Microscopic suspension laryngoscopy. Ann Otol Rhinol Laryngol. 1960 Dec;69:1134–8.

13. Linder TE, Simmen D, Stool SE. Revolutionary inventions in the 20th century. The history of endoscopy. Arch Otolaryngol Head Neck Surg. 1997 Nov;123(11):1161–3.

14. Benedict EB. Examination of the stomach by means of a flexible gastroscope: A preliminary report. N Engl J Med. 1934;210(13):669–674.

15. Sawashima M, Hirose H. New laryngoscopic technique by use of fiber optics. J Acoust Soc Am. 1968;43(1):168–169.

16. Koufman JA. Introduction to office-based surgery in laryngology. Curr Opin Otolaryngol Head Neck Surg. 2007 Dec;15(6):383–6.

17. Belafsky PC, Postma GN, Koufman JA. Normal transnasal esophagoscopy. Ear Nose Throat J. 2001 Jul;80(7):438.

18. Sinclair CF, Duke WS, Barbu AM, Randolph GW. Laryngeal Exam Indications and Techniques. In: The Recurrent and Superior Laryngeal Nerves [Internet]. Springer; 2016 [cited 2017 Jul 29]. p. 17–29. Available from: http://link.springer.com/chapter/10.1007/978-3-319-27727-1_2

19. Dunklebarger J, Rhee D, Kim S, Ferguson B. Video rigid laryngeal endoscopy compared to laryngeal mirror examination: an assessment of patient comfort and clinical visualization. The Laryngoscope. 2009 Feb;119(2):269–71.

20. Holsinger FC, Kies MS, Weinstock YE, Lewin JS, Hajibashi S, Nolen DD, et al. Examination of the Larynx and Pharynx. N Engl J Med. 2008 Jan 17;358(3):e2.

21. Rosen CA, Murry T. DIAGNOSTIC LARYNGEAL ENDOSCOPY. Otolaryngol Clin North Am. 2000 Aug 1;33(4):751–7.

22. Collins SR. Direct and indirect laryngoscopy: equipment and techniques. Respir Care. 2014 Jun;59(6):850-862; discussion 862-864.

23. Gleeson M, editor. Scott-Brown's Otorhinolaryngology: Head and Neck Surgery 7Ed: 3 volume set. 7 edition. London: Jaypee medical; 2008. 3900 p.

24. MD PWF, FACS BHHM, FRCSEd VJLCMF, MD JKN, FACS KTRM, FACS JRTM, et al. Cummings Otolaryngology: Head and Neck Surgery, 3-Volume Set, 6e. 6 edition. Philadelphia, Pa: Saunders; 2014. 3624 p.

25. Wallace FJ. Fiber Optic Endoscopy. J Urol. 1963 Sep;90(3):324–34.

26. Merati AL, Rieder AA. Normal endoscopic anatomy of the pharynx and larynx. Am J Med. 2003 Aug 18;115 Suppl 3A:10S–14S.

27. Wang DY, Bernheim N, Kaufman L, Clement P. Assessment of adenoid size in children by fibreoptic examination. Clin Otolaryngol Allied Sci. 1997 Apr;22(2):172–7.

28. Dudas JR, Deleyiannis FWB, Ford MD, Jiang S, Losee JE. Diagnosis and treatment of velopharyngeal insufficiency: clinical utility of speech evaluation and videofluoroscopy. Ann Plast Surg. 2006 May;56(5):511–517; discussion 517.

29. Bentsianov BL, Parhiscar A, Azer M, Har-El G. The role of fiberoptic nasopharyngoscopy in the management of the acute airway in angioneurotic edema. The Laryngoscope. 2000 Dec;110(12):2016–9.

30. Shah MD, Johns MM. Office-based laryngeal procedures. Otolaryngol Clin North Am. 2013 Feb;46(1):75–84.

31. Langmore SE. Evaluation of oropharyngeal dysphagia: which diagnostic tool is superior? Curr Opin Otolaryngol Head Neck Surg. 2003 Dec;11(6):485–9.

32. Kamarunas EE, McCullough GH, Guidry TJ, Mennemeier M, Schluterman K. Effects of topical nasal anesthetic on fiberoptic endoscopic examination of swallowing with sensory testing (FEESST). Dysphagia. 2014 Feb;29(1):33–43.

33. Langmore SE, Schatz K, Olsen N. Fiberoptic endoscopic examination of swallowing safety: a new procedure. Dysphagia. 1988;2(4):216–9.

34. Merati AL. In-office Evaluation of Swallowing: FEES, Pharyngeal Squeeze Maneuver, and FEESST. Otolaryngol Clin North Am. 2013 Feb 1;46(1):31–9.

35. Fuller SC, Leonard R, Aminpour S, Belafsky PC. Validation of the pharyngeal squeeze maneuver. Otolaryngol-Head Neck Surg. 2009 Mar 1;140(3):391–4.

36. Rodriguez KH, Roth CR, Rees CJ, Belafsky PC. Reliability of the Pharyngeal Squeeze Maneuver. Ann Otol Rhinol Laryngol. 2007 Jun 1;116(6):399–401.

37. Brady S, Donzelli J. The Modified Barium Swallow and the Functional Endoscopic Evaluation of Swallowing. Otolaryngol Clin North Am. 2013 Dec 1;46(6):1009–22.

38. Leder SB, Acton LM, Lisitano HL, Murray JT. Fiberoptic endoscopic evaluation of swallowing (FEES) with and without blue-dyed food. Dysphagia. 2005;20(2):157–62.

39. Aviv JE, Martin JH, Keen MS, Debell M, Blitzer A. Air pulse quantification of supraglottic and pharyngeal sensation: a new technique. Ann Otol Rhinol Laryngol. 1993 Oct;102(10):777–80.

40. Faber CE, Grymer L. Available techniques for objective assessment of upper airway narrowing in snoring and sleep apnea. Sleep Breath Schlaf Atm. 2003 Jun;7(2):77–86.

41. Svensson M, Holmstrom M, Broman J-E, Lindberg E. Can anatomical and functional features in the upper airways predict sleep apnea? A population-based study in females. Acta Otolaryngol (Stockh). 2006 Jun;126(6):613–20.

42. Charakorn N, Kezirian EJ. Drug-Induced Sleep Endoscopy. Otolaryngol Clin North Am. 2016 Dec 1;49(6):1359–72.

43. Sulica L. Laryngoscopy, Stroboscopy and Other Tools for the Evaluation of Voice Disorders. Otolaryngol Clin North Am. 2013 Feb;46(1):21–30.

44. Ni X-G, Cheng R-R, Lai S-Q, Zhang L, He S, Zhang Y-M, et al. Novel laryngoscopic strategies to improve evaluation of the site and extent of primary hypopharyngeal tumours. J Laryngol Amp Otol. 2013 Sep;127(9):882–9.

45. Rosen CA, Amin MR, Sulica L, Simpson CB, Merati AL, Courey MS, et al. Advances in office-based diagnosis and treatment in laryngology. The Laryngoscope. 2009 Nov 1;119(S2):S185–212.

46. Watanabe A, Tsujie H, Taniguchi M, Hosokawa M, Fujita M, Sasaki S. Laryngoscopic Detection of Pharyngeal Carcinoma in Situ with Narrowband Imaging. The Laryngoscope. 2006 Apr 1;116(4):650–4.

47. Tibbetts KM, Tan M. Role of Advanced Laryngeal Imaging in Glottic Cancer: Early Detection and Evaluation of Glottic Neoplasms. Otolaryngol Clin North Am. 2015 Aug 1;48(4):565–84.

48. Steele TO, Meyers A. Early Detection of Premalignant Lesions and Oral Cancer. Otolaryngol Clin North Am. 2011 Feb 1;44(1):221–9.

49. Oak C, Ahn Y-C, NAM S-J, Hong Jung M, Seok Hwang S, Chae Y-G, et al. Multimodal imaging using optical coherence tomography and endolaryngeal ultrasonography in a new rabbit VX2 laryngeal cancer model. Lasers Surg Med. 2015 Sep 9;47.

50. Misono S, Merati AL. Evidence-Based Practice: Evaluation and Management of Unilateral Vocal Fold Paralysis. Otolaryngol Clin North Am. 2012 Oct 1;45(5):1083–108.

51. O'Leary MA, Grillone GA. Injection Laryngoplasty. Otolaryngol Clin North Am. 2006 Feb 1;39(1):43–54.

52. Mallur PS, Rosen CA. Office-Based Laryngeal Injections. Otolaryngol Clin North Am. 2013 Feb 1;46(1):85–100.

53. Damrose EJ. Percutaneous injection laryngoplasty in the management of acute vocal fold paralysis. The Laryngoscope. 2010 Aug 1;120(8):1582–90.

54. Courey MS. Homologous collagen substances for vocal fold augmentation. The Laryngoscope. 2001 May;111(5):747–58.

55. Blankenship DR, Gourin CG, Davis WB, Blanchard AR, Seybt MW, Terris DJ. Percutaneous Tracheostomy: Don't Beat Them, Join Them. The Laryngoscope. 2004 Sep 1;114(9):1517–21.

56. Kost KM. Endoscopic Percutaneous Dilatational Tracheotomy: A Prospective Evaluation of 500 Consecutive Cases. The Laryngoscope. 2005 Oct 1;115(S107):1–30.

57. Randell T, Hakala P. Fibreoptic intubation and bronchofibrescopy in anaesthesia and intensive care. Acta Anaesthesiol Scand. 1995 Jan 1;39(1):3–16.

58. Poletto CJ, Verdun LP, Strominger R, Ludlow CL. Correspondence between laryngeal vocal fold movement and muscle activity during speech and nonspeech gestures. J Appl Physiol. 2004 Sep 1;97(3):858–66.

59. Tsunoda A, Ishihara A, Kishimoto S, Tsunoda* R, Tsunoda K. Head torsion technique for detailed observation of larynx and hypopharynx. J Laryngol Amp Otol. 2007 May;121(5):489–90.

60. Spraggs PD, Harries ML. The modified Valsalva manoeuvre to improve visualization of the hypopharynx during flexible nasopharyngoscopy. J Laryngol Otol. 1995 Sep;109(9):863–4.

61. Hillel AD, Schwartz AN. Trumpet maneuver for visual and CT examination of the pyriform sinus and retrocricoid area. Head Neck. 1989 Jun;11(3):231–6.

62. Colquhoun-Flannery W, Davis A, Carruth JA. Improving the endoscopic view of the hypopharynx with anterior neck traction during the trumpet manoeuvre. J Laryngol Otol. 2000 Apr;114(4):283–4.

63. Sakai A, Okami K, Sugimoto R, Ebisumoto K, Yamamoto H, Maki D, et al. A new technique to expose the hypopharyngeal space: The modified Killian's method. Auris Nasus Larynx. 2014 Apr;41(2):207–10.

64. Murono S, Tsuji A, Endo K, Kondo S, Wakisaka N, Yoshizaki T. Evaluation of modified Killian's method: A technique to expose the hypopharyngeal space. The Laryngoscope. 2014 Nov 1;124(11):2526–30.

65. Cherko M, Ghufoor K. A manoeuvre to enhance subglottic view during flexible laryngoscopy. Clin Otolaryngol Off J ENT-UK Off J Neth Soc Oto-Rhino-Laryngol Cervico-Facial Surg. 2016 Aug;41(4):437–8.

66. Marks JM, Dunkin BJ, editors. Principles of Flexible Endoscopy for Surgeons. 2013 edition. New York, NY: Springer; 2013. 281 p.

67. Petersen BT, Cohen J, Hambrick RD, Buttar N, Greenwald DA, Buscaglia JM, et al. Multisociety guideline on reprocessing flexible GI endoscopes: 2016 update. Gastrointest Endosc. 2017 Feb 1;85(2):282–294.e1.

68. Cooke RPD, Goddard SV, Whymant-Morris A, Sherwood J, Chatterly R. An evaluation of Cidex OPA (0.55% ortho-phthalaldehyde) as an alternative to 2% glutaraldehyde for high-level disinfection of endoscopes. J Hosp Infect. 2003 Jul;54(3):226–31.

69. de Blic J, Marchac V, Scheinmann P. Complications of flexible bronchoscopy in children: prospective study of 1,328 procedures. Eur Respir J. 2002 Nov;20(5):1271–6.

70. Walshe P, Rowley H, Hone S, Timon C. Co-phenylcaine as an alternative to Brompton's solution in rigid nasendoscopy: a pilot study. J Clin Pharm Ther. 2002 Jun 1;27(3):185–7.

71. Pothier D d., Awad Z, Whitehouse M, Porter G c. The use of lubrication in flexible fibreoptic nasendoscopy: a randomized controlled trial. Clin Otolaryngol. 2005 Aug 1;30(4):353–6.

72. Postma GN, Cohen JT, Belafsky PC, Halum SL, Gupta SK, Bach KK, et al. Transnasal esophagoscopy: revisited (over 700 consecutive cases). The Laryngoscope. 2005 Feb;115(2):321–3.

73. Verma SP, Smith ME, Dailey SH. Transnasal tracheoscopy. The Laryngoscope. 2012 Jun;122(6):1326–30.

74. Neal JM, Bernards CM, Butterworth JF, Di Gregorio G, Drasner K, Hejtmanek MR, et al. ASRA practice advisory on local anesthetic systemic toxicity. Reg Anesth Pain Med. 2010 Apr;35(2):152–61.

75. Kwok S, Fischer JL, Rogers JD. Benzocaine and lidocaine induced methemoglobinemia after bronchoscopy: a case report. J Med Case Reports. 2008 Jan 23;2:16.

76. Sadek SA, De R, Scott A, White AP, Wilson PS, Carlin WV. The efficacy of topical anaesthesia in flexible nasendoscopy: a double-blind randomised controlled trial. Clin Otolaryngol Allied Sci. 2001 Feb;26(1):25–8.

77. Lennox P, Hern J, Birchall M, Lund V. Local anaesthesia in flexible nasendoscopy. A comparison between cocaine and co-phenylcaine. J Laryngol Otol. 1996 Jun;110(6):540–2.

78. Smith JC, Rockley TJ. A comparison of cocaine and "co-phenylcaine" local anaesthesia in flexible nasendoscopy. Clin Otolaryngol Allied Sci. 2002 Jun;27(3):192–6.

APPENDIX

INFORMATION SHEET

ChristianMedicalCollege, Vellore
Department of ENT

STUDY TITLE: To study the effectiveness and tolerance of various agents used in nose prior to nasopharyngolaryngoscopy (NPL).

AIM OF STUDY: Nasopharyngolaryngoscopy (NPL) is performed in order to examine the anatomy of the nasal cavity, the postnasal space, the pharynx and the larynx, when diagnosing benign and malignant disease, or looking for foreign bodies. NPL involves examination of the nose, pharynx and larynx by passing a thin tube which has a camera attached at one end through the nose. The study will be comparing the use of a medicated spray, medicated jelly, medicated pledgets or plain jelly in decreasing the pain/ discomfort caused during the examination. Partaking in this study will not result in any extra cost nor will it harm you in any way.

PROCEDURE: each of the participants will be randomly allotted to the 4 groups- i) the group receiving lignocaine spray, ii) the group receiving lignocaine gel, iii) the group receiving xylometazoline+lignocaine pledgets, iv) the group receiving plain water based gel. After completion of the endoscopy examination, the participants will be required to answer a few questions on their experience of having an endoscopy done.

RISKS OR DISCOMFORT TO THE SUBJECT: Either of these drugs mentioned above are used just before performing endoscopy. The side effects if any are few and would include bitter taste, choking or throat numbness, difficulty swallowing and rarely bleeding from the nose or throat.

BENEFITS OF STUDY: This will help us to find out the most tolerable and effective agent to be used prior to endoscopy.

CONFIDENTIALITY: Your identity will be strictly kept confidential and only the results of the study be published in a scientific journal. No one other than the treating doctors and the investigators of this study shall have access to your medical records.

PARTICIPATION: Your participation in the study is voluntary and you are free to withdraw at any time, without giving any reason. Refusal to participate in the research study will not involve any penalty or loss of benefits to which you are otherwise entitled.

COST: There is absolutely no additional cost to you as a result of participation in this study.

CONTACT PERSON:
Dr. Asha K Joy
Dept of ENT 1,
CMC Vellore.
Mobile: 9597758447

FORMAT FOR INFORMED CONSENT FORM FOR SUBJECTS

Informed Consent form to participate in a research study

Study Title: To study the effectiveness and tolerance of various agents used in nose prior to nasopharyngolaryngoscopy (NPL).

Study Number: _____

Subject's Initials: _____ Subject's Name: _____

Date of Birth / Age: _____

(Subject)

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions. [ ]

(ii) I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]

(iii) I understand that the Sponsor of the clinical trial, others working on the Sponsor's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published. [ ]

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s). [ ]

(v) I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable

Date: _____/_____/_____

Signatory's Name: _____ Signature:

Or

Representative: _____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____

Date: _____/_____/_____

Study Investigator's Name: _____

Signature or thumb impression of the Witness: _____

Date: _____/_____/_____

Name & Address of the Witness: _____

PATIENT QUESTIONNAIRE

Study Title: To compare ease of performing flexible transnasal endoscopy with different topical agents and methods of application

Study Number: _____

Investigator: Dr. Asha K Joy

Name : Age: Sex: 1= male

2= female

Hospital No.: Date:

PATIENT SURVEY:

Please circle the number that best applies for each category. 1 represents the least you feel the symptom and 10 represents the most you feel the symptom.

Overall pain or discomfort:									
1	2	3	4	5	6	7	8	9	10
Burning/ stinging sensation after application of agent(before scope being passed):									
1	2	3	4	5	6	7	8	9	10
Nasal pain while endoscope was passed:									
1	2	3	4	5	6	7	8	9	10
Throat pain while endoscope was passed:									
1	2	3	4	5	6	7	8	9	10
Gagging or nausea sensation:									
1	2	3	4	5	6	7	8	9	10
Unpleasant taste									
1	2	3	4	5	6	7	8	9	10
Feeling like something is stuck in your throat									
1	2	3	4	5	6	7	8	9	10
Trouble swallowing:									
1	2	3	4	5	6	7	8	9	10
Difficulty breathing:									
1	2	3	4	5	6	7	8	9	10
Level of anxiety before the test started:									
1	2	3	4	5	6	7	8	9	10
How happy would you be to repeat the test if needed									
1	2	3	4	5	6	7	8	9	10

DOCTOR QUESTIONNAIRE

Study Title: to compare ease of performing flexible transnasal endoscopy with different topical agents and methods of application

Study Number: _____

Name : Age: Sex:

Hospital No.: Date:

Endoscopy done by: Consultant / Resident Years of experience doing scopy:

Provisional diagnosis/ Indication for scopy:

DOCTOR'S SURVEY

1. On a scale of 0 to 10, give the score that best describes the ease with which you were able to perform flexible laryngoscopy on the patient (0 = unable to perform procedure at all, 10 = no problems at all)

Unable to perform									No problems at all
1	2	3	4	5	6	7	8	9	10

2. On a scale of 0 to 10, give the score that best describes the quality of the view of the different structures assessed (0= poor view, 10= excellent view)

Poor view				Average view					Excellent view
1	2	3	4	5	6	7	8	9	10

3. Please circle the adequacy of examination as appropriate:
   Complete / Partially complete / Incomplete or abandoned
4. Post-procedural complications (mark appropriately) :
   i. None
   ii. Pain
   iii. Epistaxis / intra oral bleeding
   iv. Laryngospasm
   v. Any other

DATA SHEET

D_R	age	sex	date	agent	discomfor	burn	nosepain	thrpain	gag	taste	stuck	swallow	breathe	anxiety	happy	done	experien	prov	ease	view	adequac	mishap	other	dis_dec	age_recc
	61	2	22-Aug-16	4	2	1	1	1	2	1	1	1	1	2	9	1	4	1	9	9	1	1		1.00	5.00
	33	1	22-Aug-16	1	2	3	1	1	1	1	1	1	1	6	2	1	4	1	9	9	1	1		1.00	2.00
	38	2	25-Aug-16	4	5	1	2	2	6	1	1	1	1	5	8	1	4	3	7	9	1	1		2.00	2.00
	31	1	25-Aug-16	1	3	8	3	2	7	8	1	1	1	1	8	1	4	2	6	9	1	1		1.00	2.00
	33	2	25-Aug-16	2	2	1	2	1	1	2	2	1	1	9	9	1	3	1	9	10	1	1		1.00	2.00
	28	2	25-Aug-16	3	1	1	1	1	1	1	1	1	1	2	10	1	3	1	10	8	1	1		1.00	1.00
	66	1	25-Aug-16	2	1	1	1	1	1	1	1	1	2	2	9	1	3	1	10	10	1	1		1.00	5.00
	35	1	25-Aug-16	1	1	2	1	1	1	1	1	1	1	3	7	1	3	1	10	10	1	1		1.00	2.00
	35	1	25-Aug-16	4	1	1	1	1	1	1	1	1	1	4	7	1	3	1	10	10	1	1		1.00	2.00
	31	2	26-Aug-16	2	2	3	1	2	7	3	5	3	1	8	3	1	3	1	10	10	1	1		1.00	2.00
	47	2	26-Aug-16	3	1	3	1	1	1	2	1	1	1	4	9	1	2	1	9	10	1	1		1.00	3.00
	62	1	27-Aug-16	3	5	2	2	3	8	6	2	1	1	8	3	1	2	2	3	6	1	1		2.00	5.00
	41	1	27-Aug-16	2	1	1	1	1	1	1	1	1	1	3	9	1	3	1	9	9	1	1		1.00	3.00
	66	2	27-Aug-16	2	2	2	1	1	1	3	2	1	1	2	9	1	3	1	8	8	1	1		1.00	5.00
	28	2	30-Aug-16	3	4	2	3	3	3	1	1	1	1	9	5	1	3	1	5	5	1	1		2.00	1.00
	67	1	1-Sep-16	1	1	1	1	1	1	1	1	1	1	2	10	1	3	1	5	7	1	1		1.00	5.00
	63	2	1-Sep-16	4	1	1	1	1	1	1	1	1	1	8	9	1	3	1	7	6	1	1		1.00	5.00
	20	1	1-Sep-16	1	1	3	1	1	1	1	1	1	1	4	9	1	3	1	7	9	1	1		1.00	1.00
	20	2	1-Sep-16	3	1	1	1	2	1	1	1	1	1	9	9	1	3	1	7	9	1	1		1.00	1.00
	35	1	1-Sep-16	3	3	2	3	1	1	1	1	1	1	2	9	1	3	1	8	8	1	1		1.00	2.00
	19	2	1-Sep-16	3	3	2	2	1	1	1	1	1	1	8	8	1	3	1	9	8	1	1		1.00	1.00
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	45	2	1-Sep-16	4	4	1	2	2	7	1	1	1	1	9	6	1	3	1	4	7	1	1		2.00	3.00
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	48	1	2-Sep-16	1	5	2	3	2	4	1	1	1	1	6	6	1	1	2	8	9	1	1		2.00	3.00
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	43	2	2-Sep-16	2	3	1	3	2	1	1	1	1	1	9	7	1	1	1	9	8	1	1		1.00	3.00
	30	1	2-Sep-16	2	3	1	2	1	1	1	1	1	1	3	9	1	1	1	7	8	1	1		1.00	1.00
	33	1	2-Sep-16	3	4	2	4	1	1	1	1	1	1	6	7	1	1	3	8	8	1	1		2.00	2.00
	53	2	2-Sep-16	2	3	1	2	1	1	1	1	1	1	9	7	1	1	1	7	8	1	1		1.00	4.00
	66	2	2-Sep-16	4	5	1	4	2	4	2	1	1	1	9	4	1	1	1	6	8	1	1		2.00	5.00
	62	1	#NULL!	2	1	1	1	1	1	1	1	1	1	3	9	1	1	2	9	7	1	1		1.00	5.00
	41	1	2-Sep-16	3	5	2	3	3	3	1	1	1	1	9	4	1	1	2	7	9	1	1		2.00	3.00
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	40	2	2-Sep-16	4	5	2	6	2	1	1	1	1	1	9	6	1	1	1	9	8	1	1		2.00	2.00
	62	2	2-Sep-16	2	1	1	1	1	1	1	1	1	1	4	9	1	1	1	9	9	1	1		1.00	5.00
	57	2	2-Sep-16	1	2	1	1	1	1	1	1	1	1	5	9	1	1	1	9	9	1	1		1.00	4.00
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	69	1	9-Sep-16	1	7	3	5	4	4	1	1	1	1	5	6	1	4	2	5	7	1	1		2.00	5.00
	76	1	9-Sep-16	3	4	2	1	2	1	1	1	1	1	7	9	1	2	2	8	8	1	1		2.00	6.00
	52	1	9-Sep-16	4	3	1	2	2	1	1	1	1	1	6	9	1	2	2	9	8	1	1		1.00	4.00
	45	2	9-Sep-16	1	3	2	1	1	6	1	1	1	1	7	9	1	2	1	9	7	1	1		1.00	3.00
	39	1	9-Sep-16	2	7	2	2	5	7	1	1	1	1	6	4	1	2	1	5	7	1	1		2.00	2.00
	45	1	#NULL!	2	3	1	2	1	1	1	1	1	1	7	9	1	3	2	8	8	1	1		1.00	3.00
	73	2	9-Sep-16	1	3	1	1	1	3	1	1	1	2	7	7	1	3	2	6	6	1	1		1.00	6.00
	70	1	9-Sep-16	4	4	1	1	1	3	1	1	1	1	7	8	1	3	1	9	8	1	1		2.00	5.00
	45	2	#NULL!	2	2	1	1	1	1	1	1	1	1	8	8	1	3	1	9	9	1	1		1.00	3.00
	25	1	9-Sep-16	3	2	1	1	1	1	1	1	1	1	7	7	1	3	2	7	7	1	1		1.00	1.00
	58	1	9-Sep-16	2	3	1	1	1	1	1	1	1	1	6	9	1	3	2	9	8	1	1		1.00	4.00
	65	1	17-Sep-16	2	2	1	3	1	3	1	1	1	1	4	9	1	4	3	10	6	1	1		1.00	5.00
	28	1	22-Sep-16	4	4	1	1	3	1	1	1	1	1	4	9	1	4	1	10	10	1	1		2.00	1.00
	26	1	23-Sep-16	3	2	3	1	1	1	1	1	1	1	4	9	1	4	1	9	9	1	1		1.00	1.00
	46	1	23-Sep-16	1	3	2	2	2	1	1	1	1	1	5	8	1	4	1	8	9	1	1		1.00	3.00
	41	2	23-Sep-16	1	2	1	1	1	1	1	1	1	1	8	9	1	3	1	10	10	1	1		1.00	3.00
	40	1	#NULL!	3	3	1	1	1	1	1	1	1	1	9	9	1	4	1	8	8	1	1		1.00	2.00
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	20	1	27-Sep-16	1	5	5	4	5	2	3	2	1	1	8	3	1	3	1	10	10	1	1		2.00	1.00
	35	1	27-Sep-16	3	1	1	1	1	1	1	1	1	1	6	9	1	3	3	10	10	1	1		1.00	2.00
	34	2	27-Sep-16	2	3	1	1	1	1	1	1	1	1	8	9	1	3	1	9	10	1	1		1.00	2.00
	47	2	29-Sep-16	4	3	1	2	1	1	1	1	1	1	4	9	1	4	1	10	10	1	1		1.00	3.00
	####	####	#NULL!	#NULL!	#NULL!	####	#NULL!	#NULL!	####	#####	#NULL!	#NULL!	#NULL!	#NULL!	#NULL!	#####	#NULL!	#####	####	#####	#NULL!	#####		#NULL!	#NULL!
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	54	2	4-Oct-16	2	4	2	3	3	1	1	1	1	1	8	7	1	4	1	9	9	1	1		2.00	4.00
	69	2	4-Oct-16	1	2	3	1	1	1	1	1	1	1	5	9	1	3	1	8	9	1	1		1.00	5.00
	27	1	4-Oct-16	4	5	1	1	2	1	1	1	1	3	7	7	1	3	1	7	8	1	1		2.00	1.00
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	45	2	4-Oct-16	3	4	2	4	2	2	1	1	1	1	9	7	1	3	1	8	10	1	1	gag	2.00	3.00
	35	2	4-Oct-16	2	6	2	6	2	3	2	1	1	0	8	6	1	3	1	8	8	1	1		2.00	#NULL!
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	37	2	11-Oct-16	1	3	3	3	1	1	1	1	1	1	9	6	1	4	1	8	8	1	1		1.00	2.00
	31	1	11-Oct-16	3	3	2	1	1	2	1	3	1	1	5	9	1	4	3	9	9	1	1		1.00	2.00
	36	2	12-Oct-16	4	3	1	3	1	1	1	1	1	1	7	8	1	4	1	8	8	1	1		1.00	2.00
	35	2	11-Oct-16	2	1	1	1	1	1	1	1	1	1	6	9	1	4	1	8	8	1	1		1.00	2.00
	52	1	12-Oct-16	2	7	1	4	2	7	1	1	1	1	6	6	1	4	1	5	8	1	1		2.00	4.00
	22	2	12-Oct-16	1	3	1	2	1	1	1	1	1	1	6	9	1	2	1	9	8	1	1		1.00	1.00
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	35	1	13-Oct-16	2	3	1	3	1	1	1	1	1	1	5	8	1	4	1	10	10	1	1		1.00	2.00
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	26	1	13-Oct-16	1	5	1	2	2	5	1	1	1	1	8	7	1	3	1	9	10	1	1		2.00	1.00
	18	2	13-Oct-16	2	1	1	1	1	1	1	1	1	1	5	7	1	3	1	10	10	1	1		1.00	1.00
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	43	1	14-Oct-16	3	4	1	2	2	6	1	1	1	1	8	5	1	3	1	4	5	1	1	gag	2.00	3.00
	40	2	14-Oct-16	1	2	2	1	1	1	1	1	1	1	9	9	1	3	1	9	9	1	1		1.00	2.00
	27	1	14-Oct-16	4	1	1	1	1	1	1	1	1	1	4	9	1	3	1	9	9	1	1		1.00	1.00
	30	2	14-Oct-16	3	2	1	1	1	1	1	1	1	1	7	9	1	3	1	9	9	1	1		1.00	1.00
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	50	1	19-Oct-16	2	3	1	1	1	1	1	1	1	1	8	9	1	2	1	9	9	1	1		1.00	3.00
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	32	1	1-Nov-16	4	2	1	1	1	1	1	1	1	1	6	9	1	3	1	9	9	1	1		1.00	2.00
	28	1	1-Nov-16	3	2	1	1	1	1	1	1	1	1	3	10	1	3	1	10	10	1	1		1.00	1.00
	45	1	1-Nov-16	4	2	1	2	1	1	1	1	1	1	4	9	1	3	1	8	8	1	1		1.00	3.00
	35	1	1-Nov-16	2	9	1	10	2	1	1	1	1	1	9	1	1	3	1	8	9	1	1		3.00	2.00
	27	1	1-Nov-16	2	2	1	1	1	1	1	1	1	1	4	9	1	3	1	9	9	1	1		1.00	1.00
	26	1	1-Nov-16	4	4	1	2	2	2	1	1	1	1	8	9	1	3	1	9	10	1	1		2.00	1.00
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	69	1	1-Nov-16	4	6	1	6	2	1	1	1	1	1	8	9	1	3	1	9	9	1	1		2.00	5.00
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	39	2	1-Nov-16	4	2	1	2	1	1	1	1	1	1	4	9	1	3	1	9	9	1	1		1.00	2.00
	29	1	1-Nov-16	3	2	1	2	1	1	1	1	1	1	8	9	1	3	1	9	9	1	1		1.00	1.00
	24	1	2-Nov-16	3	3	2	1	1	1	1	1	1	1	10	7	1	3	1	9	9	1	1		1.00	1.00
	28	2	2-Nov-16	3	2	1	1	1	1	1	1	1	1	8	8	1	3	1	9	9	1	1		1.00	1.00
	49	2	2-Nov-16	2	2	1	1	1	1	1	1	1	1	7	9	1	2	1	9	9	1	1		1.00	3.00

47	1	2-Nov-16	4	3	1	2	1	1	1	1	1	1	8	9	1	3	2	9	9	1	1		1.00	3.00
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28	1	8-Nov-16	1	2	1	1	1	2	1	1	1	1	3	9	1	3	1	10	9	1	1		1.00	1.00
73	1	9-Nov-16	3	3	1	1	1	1	1	1	1	1	4	9	1	3	1	9	9	1	1		1.00	6.00
38	1	9-Nov-16	4	5	1	2	1	1	1	1	1	1	4	8	1	2	3	7	8	1	1		2.00	2.00
28	1	9-Nov-16	2	2	1	1	1	1	1	1	1	1	2	9	1	3	1	10	10	1	1		1.00	1.00
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37	1	10-Nov-16	3	4	2	1	1	3	2	1	1	1	8	7	1	3	1	9	9	1	1		2.00	2.00
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60	1	10-Nov-16	2	2	1	1	1	1	1	1	1	1	2	9	1	4	1	7	7	1	1		1.00	4.00
49	2	10-Nov-16	4	4	2	1	1	1	1	1	1	1	8	9	1	4	1	8	8	1	1		2.00	3.00
58	1	10-Nov-16	1	2	2	1	1	1	1	1	1	1	3	9	1	4	1	9	9	1	1		1.00	4.00
44	1	10-Nov-16	1	4	3	2	1	3	1	1	1	1	4	7	1	4	1	10	10	1	1		2.00	3.00
53	2	10-Nov-16	3	3	1	1	1	2	1	1	1	1	7	7	1	4	1	10	10	1	1		1.00	4.00
42	1	10-Nov-16	4	2	1	1	1	1	1	1	1	1	9	7	1	4	1	9	9	1	1		1.00	3.00
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23	1	10-Nov-16	2	3	1	1	1	2	1	1	1	1	6	9	1	4	1	6	9	1	1		1.00	1.00
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53	1	15-Nov-16	1	3	2	1	1	2	1	1	1	1	3	8	1	1	1	8	8	1	1		1.00	4.00
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28	1	15-Nov-16	1	4	1	2	3	1	1	1	1	1	6	8	1	3	1	9	7	1	1		2.00	1.00
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54	1	16-Nov-16	2	3	1	1	1	1	1	1	1	1	5	8	1	2	4	8	8	1	1		1.00	4.00
28	2	16-Nov-16	2	2	1	1	1	1	1	1	1	1	7	9	1	2	3	9	9	1	1		1.00	1.00
54	1	16-Nov-16	3	2	1	1	1	1	1	1	1	1	8	9	1	2	1	9	9	1	1		1.00	4.00
43	1	16-Nov-16	4	3	1	1	1	1	1	1	1	1	4	9	1	2	1	7	9	1	1		1.00	3.00
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70	1	16-Nov-16	1	2	1	1	1	1	1	1	1	1	3	10	1	2	1	9	9	1	1		1.00	5.00
18	2	16-Nov-16	4	6	1	1	2	4	1	1	1	1	9	6	1	2	1	8	10	1	1		2.00	1.00
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60	1	17-Nov-16	2	3	1	1	1	1	1	1	1	1	4	9	1	4	1	10	10	1	1		1.00	4.00
59	1	17-Nov-16	3	2	1	1	1	1	1	1	1	1	4	9	1	4	1	9	9	1	1		1.00	4.00
22	2	17-Nov-16	2	4	1	1	1	1	1	1	1	1	8	6	1	4	1	7	9	1	1		2.00	1.00
33	2	17-Nov-16	3	2	1	1	1	1	1	1	1	1	8	8	1	4	1	10	10	1	1		1.00	2.00
42	2	17-Nov-16	4	4	1	1	1	1	1	1	1	1	7	4	1	4	1	8	8	1	1		2.00	3.00
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41	2	17-Nov-16	3	3	2	1	1	1	1	1	1	1	8	6	1	4	1	9	10	1	1		1.00	3.00
68	1	17-Nov-16	1	2	1	1	1	1	1	1	1	1	3	9	1	4	2	7	10	1	1		1.00	5.00
27	2	22-Nov-16	2	2	1	1	1	1	1	1	1	1	8	9	1	3	3	9	10	1	1		1.00	1.00
41	1	22-Nov-16	3	3	1	1	1	1	1	1	1	1	8	6	1	4	1	10	10	1	1		1.00	3.00
36	2	22-Nov-16	4	3	1	1	1	1	1	1	1	1	5	3	1	4	1	10	10	1	1		1.00	2.00
41	1	22-Nov-16	1	2	1	1	1	1	1	1	1	1	7	8	1	4	1	10	10	1	1		1.00	3.00
67	1	22-Nov-16	1	3	2	1	1	1	1	1	1	1	7	7	1	4	1	9	10	1	1		1.00	5.00
40	1	22-Nov-16	4	6	1	3	1	1	1	1	1	1	6	9	1	4	1	9	9	1	1		2.00	2.00
34	1	22-Nov-16	4	3	1	1	1	1	1	1	1	1	8	9	1	4	1	9	8	1	1		1.00	2.00
25	1	22-Nov-16	3	2	1	1	1	1	1	1	1	1	7	9	1	3	1	10	10	1	1		1.00	1.00

49	2	23-Nov-16	4	3	1	1	1	1	1	1	1	1	7	7	1	2	1	9	8	1	1		1.00	3.00
45	2	23-Nov-16	3	3	1	1	1	1	1	1	1	1	7	9	1	2	1	9	9	1	1		1.00	3.00
33	2	23-Nov-16	1	2	1	1	1	1	1	1	1	1	8	9	1	2	2	9	9	1	1		1.00	2.00
18	2	23-Nov-16	3	3	1	1	2	1	1	1	1	1	8	9	1	2	1	10	10	1	1		1.00	1.00
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29	1	29-Nov-16	1	3	1	1	1	1	1	1	1	1	4	9	1	3	1	3	3	2	1	gag	1.00	1.00
28	1	29-Nov-16	4	2	1	1	1	1	1	1	1	1	6	8	1	3	1	9	9	1	1		1.00	1.00
48	2	29-Nov-16	2	5	1	1	1	6	1	1	1	1	8	3	1	3	1	3	3	2	1	gag	2.00	3.00
53	1	29-Nov-16	3	2	1	1	1	1	1	1	1	1	7	9	1	3	1	9	9	1	1		1.00	4.00
44	1	29-Nov-16	1	4	1	1	1	6	1	1	1	1	6	4	1	3	2	2	3	2	1	gag	2.00	3.00
40	1	29-Nov-16	2	2	1	1	1	1	1	1	1	1	7	8	1	3	3	9	9	1	1		1.00	2.00
39	1	29-Nov-16	2	2	1	1	1	1	1	1	1	1	4	9	1	3	1	7	8	1	1		1.00	2.00
54	1	29-Nov-16	4	2	1	1	1	1	1	1	1	1	6	9	1	3	3	8	8	1	1		1.00	4.00
45	2	29-Nov-16	1	4	1	1	1	3	1	1	1	1	7	3	1	3	1	6	5	1	1		2.00	3.00
45	2	1-Dec-16	2	2	1	1	1	1	1	1	1	1	6	7	1	4	1	10	10	1	1		1.00	3.00
70	1	1-Dec-16	1	2	1	1	1	1	1	1	1	1	6	8	1	4	3	9	9	1	1		1.00	5.00
36	2	1-Dec-16	2	2	1	1	1	1	1	1	1	1	7	7	1	4	1	8	8	1	1		1.00	2.00
40	2	1-Dec-16	3	4	2	2	1	1	1	1	1	1	6	7	1	4	1	9	9	1	1		2.00	2.00
42	2	1-Dec-16	4	3	1	1	1	1	1	1	1	1	7	5	1	4	1	8	8	1	1		1.00	3.00
33	1	1-Dec-16	2	2	1	1	1	1	1	1	1	1	4	8	1	4	1	9	9	1	1		1.00	2.00
35	2	6-Dec-16	4	2	1	1	1	1	1	1	1	1	8	7	1	4	1	10	10	1	1		1.00	2.00
60	1	6-Dec-16	1	2	2	1	1	1	1	1	1	1	5	9	1	4	1	9	9	1	1		1.00	4.00
39	2	6-Dec-16	3	2	1	1	1	2	1	1	1	1	8	5	1	4	1	8	9	1	1		1.00	2.00
30	1	7-Dec-16	4	2	1	1	1	1	1	1	1	1	8	9	1	4	1	8	8	1	1		1.00	1.00
41	1	7-Dec-16	3	2	1	1	1	1	1	1	1	1	7	8	1	2	1	9	9	1	1		1.00	3.00
25	2	7-Dec-16	3	4	2	3	1	1	1	1	1	1	8	6	1	2	1	9	9	1	1		2.00	1.00
25	1	7-Dec-16	4	2	1	1	1	1	1	1	1	1	5	9	1	2	1	10	9	1	1		1.00	1.00
39	1	13-Dec-16	4	2	1	1	1	1	1	1	1	1	4	9	1	3	1	10	10	1	1		1.00	2.00
41	1	15-Dec-16	3	2	1	1	1	1	1	1	1	1	3	9	1	4	2	10	10	1	1		1.00	3.00
21	1	13-Dec-16	3	3	1	2	1	1	1	1	1	1	5	7	1	2	1	8	8	1	1		1.00	1.00
29	1	#NULL!	2	2	1	1	1	1	1	1	1	1	8	8	1	2	1	9	9	1	1		1.00	1.00
39	1	13-Dec-16	1	3	2	2	1	1	1	1	1	1	9	7	1	2	1	8	8	1	1		1.00	2.00
39	2	13-Dec-16	2	3	1	1	1	1	1	1	1	1	7	8	1	4	1	8	10	1	1		1.00	2.00
41	2	15-Dec-16	4	2	1	1	1	1	1	1	1	1	7	8	1	4	1	7	10	1	1		1.00	3.00
36	2	#NULL!	1	3	3	1	1	1	1	1	1	1	7	9	1	4	1	10	10	1	1		1.00	2.00
39	2	15-Dec-16	3	2	1	1	1	1	1	1	1	1	8	9	1	4	1	10	10	1	1		1.00	2.00
33	2	15-Dec-16	4	2	1	1	1	1	1	1	1	1	7	9	1	4	1	10	10	1	1		1.00	2.00
41	1	15-Dec-16	1	4	1	1	1	1	1	1	1	1	5	8	1	4	2	10	10	1	1		2.00	3.00
61	2	15-Dec-16	3	3	2	1	1	1	1	1	1	1	3	6	1	4	1	10	10	1	1		1.00	5.00
49	2	15-Dec-16	1	3	1	1	1	1	1	1	1	1	9	6	1	4	1	8	9	1	1		1.00	3.00
30	2	15-Dec-16	3	1	1	1	1	1	1	1	1	1	5	6	1	4	1	10	10	1	1		1.00	1.00
69	1	15-Dec-16	2	3	1	1	1	1	1	1	1	1	3	8	1	4	2	9	10	1	1		1.00	5.00
71	2	#NULL!	3	2	1	1	1	1	1	1	1	1	5	8	1	4	1	8	9	1	1		1.00	6.00
46	1	#NULL!	4	2	1	1	1	1	1	1	1	1	6	9	1	4	2	8	8	1	1		1.00	3.00
55	1	#NULL!	2	4	2	3	1	1	1	1	1	1	4	9	1	4	1	10	10	1	1		2.00	4.00
24	2	#NULL!	4	3	1	1	1	1	1	1	1	1	9	7	1	2	1	9	9	1	1		1.00	1.00
36	2	17-Jan-17	1	4	1	1	2	2	1	1	1	1	6	4	1	4	1	3	8	1	1		2.00	2.00
30	1	#NULL!	2	2	3	1	1	1	1	1	1	1	5	8	1	4	1	9	9	1	1		1.00	1.00
32	1	#NULL!	1	3	2	2	1	1	1	1	1	1	6	7	1	2	1	8	8	1	1		1.00	2.00
65	2	6-Jul-17	3	2	1	1	1	1	1	1	1	1	5	9	1	3	2	5	10	1	1		1.00	5.00
33	2	6-Jul-17	2	2	1	1	1	1	1	1	1	1	5	9	1	3	2	10	10	1	1		1.00	2.00
31	2	#NULL!	3	3	3	2	1	1	1	1	1	1	9	6	1	3	1	10	10	1	1		1.00	2.00
55	1	#NULL!	4	4	2	3	4	8	1	1	1	1	5	7	1	3	2	1	1	3	2	switched	2.00	4.00
44	1	6-Jul-17	2	3	1	1	1	1	1	1	1	1	8	9	1	3	2	9	9	1	1		1.00	3.00
44	2	#NULL!	1	3	1	1	1	1	1	1	1	1	5	9	1	2	1	7	7	1	1		1.00	3.00
31	2	#NULL!	2	3	1	3	2	1	1	1	1	1	9	3	1	2	1	8	8	1	1		1.00	2.00
30	2	#NULL!	1	2	1	1	1	1	3	2	1	1	8	8	1	2	1	8	8	1	1		1.00	1.00
22	2	#NULL!	3	4	3	3	1	1	1	1	1	1	9	9	1	2	1	7	5	1	1		2.00	1.00
53	2	#NULL!	4	2	1	1	1	1	1	1	1	1	7	8	1	2	1	10	10	1	1		1.00	4.00

36	1	#NULL!	3	3	2	1	1	1	1	1	1	1	6	9	1	2	1	9	9	1	1		1.00	2.00
28	2	7-Jul-17	4	3	2	2	1	1	1	1	1	1	9	7	1	2	1	10	10	1	1		1.00	1.00
41	2	#NULL!	4	2	1	2	2	1	1	1	1	1	8	8	1	2	1	9	9	1	1		1.00	3.00
32	1	7-Jul-17	4	3	1	1	1	1	1	1	1	1	6	7	1	2	1	8	8	1	1		1.00	2.00
28	1	#NULL!	1	3	1	1	1	1	1	1	1	1	7	9	1	2	1	9	9	1	1		1.00	1.00
45	1	10-Jul-17	1	2	1	1	1	1	1	1	1	1	7	8	1	2	1	9	9	1	1		1.00	3.00
48	1	10-Jul-17	4	3	1	2	1	1	1	1	1	1	9	7	1	4	1	9	9	1	1		1.00	3.00
55	1	#NULL!	2	2	1	1	1	1	1	1	1	1	6	8	1	4	1	8	8	1	1		1.00	4.00
62	1	11-Jul-17	3	3	1	1	1	4	1	1	1	1	4	9	1	3	2	5	8	1	1		1.00	5.00
22	1	11-Jul-17	4	2	1	1	1	1	1	1	1	1	6	6	1	3	1	10	10	1	1		1.00	1.00
29	2	11-Jul-17	2	2	1	1	1	1	1	1	1	1	6	9	1	3	1	10	10	1	1		1.00	1.00
37	2	11-Jul-17	1	4	8	2	2	1	9	10	8	1	3	2	1	3	1	10	10	1	1		2.00	2.00
35	2	11-Jul-17	2	2	1	1	1	1	1	1	1	1	9	9	1	3	1	10	10	1	1		1.00	2.00
50	1	11-Jul-17	3	2	1	1	1	1	1	1	1	1	6	8	1	3	1	10	10	1	1		1.00	3.00
48	1	#NULL!	4	3	4	1	1	2	1	1	1	1	5	5	1	3	1	8	8	1	1		1.00	3.00
27	1	#NULL!	4	4	1	2	1	3	2	1	1	1	5	8	1	4	1	8	8	1	1		2.00	1.00
31	1	#NULL!	3	4	3	1	1	1	3	1	1	1	8	8	1	1	1	8	8	1	1		2.00	2.00
43	1	#NULL!	1	4	3	1	1	1	1	1	1	1	5	8	1	1	1	8	8	1	1		2.00	3.00
51	2	12-Jul-17	1	3	3	1	1	1	1	1	1	1	5	8	1	1	1	8	8	1	1		1.00	4.00
30	2	12-Jul-17	3	3	1	1	1	1	1	1	1	1	6	9	1	1	1	8	8	1	1		1.00	1.00
57	1	12-Jul-17	4	3	1	2	1	1	1	1	1	1	5	6	1	2	2	7	8	1	1		1.00	4.00
52	2	#NULL!	2	4	1	2	2	2	1	1	1	1	5	5	1	2	2	8	8	1	1		2.00	4.00
60	1	#NULL!	4	3	1	1	1	2	1	1	1	1	8	7	1	2	1	9	9	1	1		1.00	4.00
61	1	#NULL!	3	2	1	1	1	1	1	1	1	1	6	9	1	2	1	9	9	1	1		1.00	5.00
45	1	#NULL!	1	3	1	2	1	1	1	1	1	1	6	8	1	2	1	9	9	1	1		1.00	3.00
23	2	#NULL!	3	3	1	1	1	2	1	1	1	1	9	7	1	2	1	9	9	1	1		1.00	1.00
27	2	13-Jul-17	2	4	1	1	1	1	1	1	1	1	6	8	1	3	1	8	8	1	1		2.00	1.00
56	2	14-Jul-17	4	3	1	1	1	1	1	1	1	1	7	7	1	3	1	9	9	1	1		1.00	4.00
50	1	#NULL!	2	1	1	1	1	1	1	1	1	1	2	8	1	3	1	10	10	1	1		1.00	3.00
40	1	#NULL!	3	2	1	1	1	1	1	1	1	1	5	9	1	3	1	9	9	1	1		1.00	2.00
24	2	#NULL!	1	4	2	2	2	2	1	1	1	1	10	6	1	1	1	9	9	1	1		2.00	1.00
48	2	14-Jul-17	1	5	7	3	3	3	6	6	2	2	5	7	1	3	1	10	10	1	1		2.00	3.00
35	1	15-Jul-17	4	2	1	1	1	1	1	1	1	1	8	7	1	1	1	9	9	1	1		1.00	2.00
53	1	#NULL!	1	3	1	2	1	1	1	1	1	1	7	9	1	1	1	9	9	1	1		1.00	4.00
29	1	#NULL!	2	2	1	1	1	1	1	1	1	1	9	9	1	1	1	8	8	1	1		1.00	1.00
49	2	#NULL!	2	3	1	1	1	1	1	1	1	1	8	7	1	1	1	9	9	1	1		1.00	3.00
39	2	16-Jul-17	3	3	1	1	1	1	1	1	1	1	7	8	1	1	1	8	8	1	1		1.00	2.00
20	1	#NULL!	4	3	1	1	1	1	1	1	1	1	9	8	1	1	1	8	8	1	1		1.00	1.00
51	2	18-Jul-17	2	3	2	2	2	2	1	1	1	1	9	6	1	2	1	9	9	1	1		1.00	4.00
41	2	#NULL!	1	2	1	1	1	1	1	1	1	1	8	8	1	2	1	9	9	1	1		1.00	3.00
54	2	#NULL!	4	3	1	1	1	1	1	1	1	1	8	7	1	2	1	9	9	1	1		1.00	4.00
55	2	#NULL!	4	2	1	1	1	1	1	1	1	1	8	8	1	2	1	8	8	1	1		1.00	4.00
36	2	#NULL!	1	3	1	2	1	2	1	1	1	1	10	6	1	2	1	8	8	1	1		1.00	2.00
34	1	#NULL!	3	3	2	1	3	2	1	2	2	2	4	3	1	2	3	7	7	1	1		1.00	2.00
52	1	#NULL!	1	2	1	1	1	1	1	1	1	1	5	8	1	2	1	9	9	1	1		1.00	4.00
34	2	#NULL!	3	3	1	1	1	1	1	1	1	1	7	7	1	2	1	8	8	1	1		1.00	2.00
41	2	19-Jul-17	1	2	2	2	1	2	1	1	1	1	6	8	1	2	1	8	8	1	1		1.00	3.00
42	2	#NULL!	3	3	1	2	1	1	1	1	1	1	8	7	1	2	1	7	8	1	1		1.00	3.00
41	1	#NULL!	2	2	1	2	1	2	1	1	1	1	7	8	1	2	1	9	9	1	1		1.00	3.00
21	2	19-Jul-17	4	2	1	1	1	1	1	1	1	1	8	6	1	2	1	8	8	1	1		1.00	1.00
42	1	#NULL!	4	3	1	1	1	1	1	1	1	1	6	9	1	2	1	9	9	1	1		1.00	3.00
43	2	#NULL!	1	4	2	2	2	1	1	1	1	1	7	7	1	2	1	9	9	1	1		2.00	3.00
64	1	#NULL!	3	2	1	1	1	1	1	1	1	1	8	8	1	2	1	10	10	1	1		1.00	5.00
33	1	#NULL!	2	3	1	1	1	1	1	1	1	1	6	9	1	2	1	10	10	1	1		1.00	2.00
30	1	#NULL!	4	2	1	1	1	1	1	1	1	1	8	8	1	1	1	9	9	1	1		1.00	1.00
22	1	20-Jul-17	2	4	2	2	2	3	2	1	1	1	7	8	1	1	1	8	8	1	1		2.00	1.00
52	2	#NULL!	3	2	1	2	1	1	1	1	1	1	10	8	1	1	1	9	9	1	1		1.00	4.00
34	2	#NULL!	1	3	1	1	1	1	1	1	1	1	8	8	1	1	1	9	9	1	1		1.00	2.00
45	2	20-Jul-17	3	3	2	2	2	1	1	1	1	1	6	7	1	3	1	8	8	1	1		1.00	3.00
74	1	#NULL!	3	3	2	1	2	1	1	1	1	1	8	9	1	3	2	8	8	1	1		1.00	6.00
46	2	#NULL!	4	2	1	2	2	1	1	1	1	1	8	7	1	3	1	9	9	1	1		1.00	3.00
28	2	#NULL!	2	3	1	1	1	1	2	1	1	1	10	5	1	3	1	9	9	1	1		1.00	1.00
53	1	#NULL!	2	2	1	1	1	1	1	1	1	1	6	8	1	1	2	8	8	1	1		1.00	4.00
27	2	20-Jul-17	1	4	2	1	1	1	6	1	1	1	8	6	1	3	1	9	7	1	1		2.00	1.00
63	1	#NULL!	4	3	1	1	1	1	1	1	1	1	8	8	1	3	1	9	8	1	1		1.00	5.00

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31	2	21-Jul-17	1	3	4	1	1	1	1	1	1	1	7	7	1	3	1	8	8	1	1		1.00	2.00
62	2	#NULL!	2	3	1	1	1	1	1	1	1	1	6	7	1	4	1	10	9	1	1		1.00	5.00
28	1	#NULL!	3	4	2	2	1	1	1	1	1	1	5	8	1	4	3	9	9	1	1		2.00	1.00
41	1	#NULL!	1	3	2	1	1	1	3	1	1	1	7	8	1	4	1	9	9	1	1		1.00	3.00
43	1	#NULL!	3	2	1	1	1	1	1	1	1	1	6	9	1	4	2	9	9	1	1		1.00	3.00
26	1	#NULL!	4	2	1	1	1	1	1	1	1	1	6	9	1	4	1	10	10	1	1		1.00	1.00
24	2	#NULL!	2	8	1	2	1	1	1	1	1	1	10	5	1	4	1	8	9	1	1		3.00	1.00
32	1	21-Jul-17	1	3	1	1	5	3	3	1	1	1	5	9	1	4	3	8	8	2	5	excessive	1.00	2.00
44	1	#NULL!	4	3	1	2	1	1	1	1	1	1	7	8	1	4	1	9	9	1	1		1.00	3.00
40	1	#NULL!	1	3	1	1	1	1	1	1	1	1	6	9	1	4	1	9	9	1	1		1.00	2.00
64	1	21-Jul-17	2	2	1	1	1	1	1	1	1	1	7	8	1	4	1	10	10	1	1		1.00	5.00
61	2	#NULL!	2	3	1	1	1	1	1	1	1	1	7	8	1	4	1	8	9	1	1		1.00	5.00
55	2	#NULL!	3	3	1	1	1	1	1	1	1	1	5	8	1	4	2	10	10	1	1		1.00	4.00
28	2	#NULL!	4	4	1	2	1	3	1	1	1	1	5	7	1	4	1	8	9	1	1		2.00	1.00
60	1	22-Jul-17	1	2	1	1	1	1	1	1	1	1	8	8	1	4	1	8	8	1	1		1.00	4.00
60	1	22-Jul-17	3	3	1	1	1	1	1	1	1	1	9	9	1	2	1	10	10	1	1		1.00	4.00
41	2	#NULL!	2	2	1	1	1	1	1	1	1	1	9	7	1	4	1	10	10	1	1		1.00	3.00
57	2	24-Jul-17	1	3	1	2	1	2	1	1	1	1	8	8	1	1	1	8	8	1	1		1.00	4.00
69	2	#NULL!	2	3	1	1	1	1	1	1	1	1	7	8	1	1	2	8	7	1	1		1.00	5.00
50	1	#NULL!	1	3	1	1	1	2	1	1	1	1	8	8	1	1	1	8	8	1	1		1.00	3.00
26	1	#NULL!	2	2	1	1	1	1	1	1	1	1	8	9	1	1	1	9	9	1	1		1.00	1.00
25	1	#NULL!	3	2	1	1	1	1	1	1	1	1	9	7	1	1	1	9	9	1	1		1.00	1.00
55	1	25-Jul-17	1	3	2	2	1	1	1	1	1	1	6	9	1	1	1	9	9	1	1		1.00	4.00
55	1	#NULL!	2	2	1	1	1	1	2	1	1	1	6	9	1	1	1	8	8	1	1		1.00	4.00
51	2	#NULL!	3	3	1	2	1	1	1	1	1	1	8	9	1	1	1	9	9	1	1		1.00	4.00
55	1	#NULL!	4	4	1	2	2	4	2	1	1	1	6	6	1	2	2	7	7	1	1		2.00	4.00
67	1	26-Jul-17	4	3	1	1	1	1	1	1	1	1	6	9	1	1	2	7	9	1	1		1.00	5.00
43	2	#NULL!	4	3	1	2	1	2	1	1	1	1	7	6	1	1	1	9	9	1	1		1.00	3.00
26	2	#NULL!	3	2	1	1	1	3	1	4	1	1	6	8	1	1	1	8	8	1	1		1.00	1.00
43	2	#NULL!	3	5	1	1	3	1	1	1	1	1	8	7	1	1	2	8	8	1	1		2.00	3.00
44	1	#NULL!	2	2	1	1	1	1	1	1	2	1	5	8	1	1	1	9	9	1	1		1.00	3.00
62	1	27-Jul-17	2	5	1	1	1	4	1	1	1	1	6	7	1	3	1	6	6	1	1		2.00	5.00
26	1	#NULL!	1	3	2	1	1	1	1	1	1	1	6	8	1	3	1	9	9	1	1		1.00	1.00
29	1	#NULL!	1	3	1	1	1	1	2	1	1	1	6	9	1	3	1	9	9	1	1		1.00	1.00
58	2	#NULL!	4	4	2	1	1	3	1	1	1	1	9	6	1	3	1	10	10	1	1		2.00	4.00
42	1	2-Aug-17	4	2	1	1	1	1	1	1	1	1	6	8	1	2	1	9	9	1	1		1.00	3.00
39	2	#NULL!	3	2	1	1	1	1	1	1	1	1	8	8	1	2	1	8	9	1	1		1.00	2.00
64	1	28-Jul-17	1	4	2	2	2	5	1	1	1	1	7	6	2	4	2	7	7	1	1		2.00	5.00
55	1	#NULL!	1	3	1	1	1	2	1	1	1	1	6	9	1	1	2	7	7	1	1		1.00	4.00
51	2	#NULL!	1	3	2	2	1	2	1	1	1	1	9	6	1	1	1	7	8	1	1		1.00	4.00
43	1	#NULL!	2	2	1	1	1	1	1	1	1	1	6	8	1	4	1	10	10	1	1		1.00	3.00
32	1	#NULL!	3	3	1	2	1	1	1	1	1	1	8	8	1	4	1	9	9	1	1		1.00	2.00
38	2	#NULL!	2	3	1	2	1	3	2	1	1	1	8	6	1	4	1	8	8	1	1		1.00	2.00
54	1	31-Jul-17	3	3	2	1	1	1	1	1	1	1	9	7	1	3	4	7	9	1	1		1.00	4.00
27	1	#NULL!	2	2	1	1	1	1	1	1	1	1	7	9	1	4	1	9	9	1	1		1.00	1.00
56	1	#NULL!	1	3	2	1	1	1	1	1	1	1	6	9	1	3	1	9	9	1	1		1.00	4.00
22	1	#NULL!	4	3	1	2	1	2	1	1	1	1	9	8	1	3	1	8	8	1	1		1.00	1.00
59	2	#NULL!	1	2	1	1	1	1	1	1	1	1	9	7	1	3	1	10	10	1	1		1.00	4.00
65	1	#NULL!	3	4	1	2	2	3	1	1	1	1	7	7	1	3	2	7	7	1	1		2.00	5.00
55	2	31-Jul-17	4	3	1	2	1	1	1	1	1	1	9	7	1	3	1	9	9	1	1		1.00	4.00
37	1	#NULL!	1	3	3	1	1	1	1	1	1	1	6	7	1	2	1	9	8	1	1		1.00	2.00
35	2	#NULL!	4	2	1	1	1	1	1	1	1	1	8	7	1	2	1	9	8	1	1		1.00	2.00
67	1	#NULL!	2	2	1	1	1	1	1	1	1	1	6	9	1	2	1	8	8	1	1		1.00	5.00
42	1	#NULL!	3	4	1	1	1	4	1	1	1	1	8	9	1	2	1	8	8	1	1		2.00	3.00
60	1	#NULL!	4	3	1	1	1	1	1	1	1	1	7	9	1	2	1	8	8	1	1		1.00	4.00
35	1	3-Aug-17	1	4	2	1	1	2	1	1	1	1	8	8	1	3	1	8	9	1	1		2.00	2.00
27	1	#NULL!	1	5	4	1	1	4	3	2	1	1	7	7	1	3	1	7	8	1	1		2.00	1.00
35	1	#NULL!	3	4	1	1	1	1	1	1	1	1	5	8	1	3	1	9	9	1	1		2.00	2.00
40	1	#NULL!	2	4	1	1	1	2	1	1	1	1	5	7	1	2	1	8	9	1	1		2.00	2.00
40	2	#NULL!	3	3	1	1	1	1	1	1	1	1	9	7	1	3	1	9	9	1	1		1.00	2.00
31	1	#NULL!	4	5	1	2	2	4	1	1	1	1	9	5	1	3	2	7	7	1	1		2.00	2.00
24	2	#NULL!	2	4	1	4	1	1	1	1	1	1	8	6	1	3	1	8	7	1	1		2.00	1.00
80	1	#NULL!	1	4	3	1	1	1	3	1	1	1	7	9	1	3	1	8	9	1	1		2.00	6.00
46	2	#NULL!	2	3	1	1	1	1	1	1	1	1	7	8	1	3	1	9	9	1	1		1.00	3.00
27	2	#NULL!	4	3	1	1	1	1	1	1	1	1	8	7	1	3	1	8	9	1	1		1.00	1.00
32	2	#NULL!	3	3	2	1	1	1	1	1	1	1	8	9	1	3	4	9	9	1	1		1.00	2.00
25	2	#NULL!	1	4	3	5	2	1	1	1	1	1	8	7	1	3	1	8	8	1	1		2.00	1.00
34	2	#NULL!	2	3	1	1	1	1	1	1	1	1	9	8	1	3	1	9	9	1	1		1.00	2.00
25	1	#NULL!	4	2	1	1	1	1	1	1	1	1	9	8	1	3	1	9	9	1	1		1.00	1.00
62	1	#NULL!	1	5	2	2	1	4	2	1	1	1	7	7	1	3	2	8	8	1	1		2.00	5.00
23	1	#NULL!	2	3	1	1	1	2	1	1	1	1	7	9	1	3	1	8	9	1	1		1.00	1.00
33	1	16-Aug-17	4	4	1	2	1	2	1	1	1	1	5	8	1	2	2	8	8	1	1		2.00	2.00
26	2	#NULL!	3	3	2	1	1	1	3	1	1	1	6	7	1	2	1	8	8	1	1		1.00	1.00